Engineering Library
GENERAL LIBRARY
JUN 1
UNIV. OF MICH.

Compressed Air MAGAZINE

JUNE, 1919

"LITTLE DAVID" CALKING MACHINE
For Deck Calking on Steel Ships
Saves 2/3 in Labor Costs.

INGERSOLL-RAND COMPANY
GENERAL OFFICES, 11 BROADWAY, NEW YORK

DOMESTIC OFFICES

BUTTE, JUNEAU, DULUTH, DENVER, BOSTON, EL PASO, SEATTLE, ST. LOUIS, CHICAGO, NEW YORK, KNOXVILLE, SCRANTON, HOUGHTON, CLEVELAND, PITTSBURGH, BIRMINGHAM, LOS ANGELES, DETROIT, NEW ORLEANS, PHILADELPHIA, SAN FRANCISCO, SALT LAKE CITY, JOPLIN

FOREIGN OFFICES

LONDON, PARIS, MADRID, MILAN, RIO DE JANEIRO, MONTREAL, MEXICO CITY, MELBOURNE, KALGOORLIE, JOHANNESBURG, SANTIAGO, CHILE, LIMA, PERU, KOBE, JAPAN, MANILA, TOKIO, HONOLULU, HAVANA, BUENOS AIRES, ANTOFAGASTA, LA PAZ, BOLIVIA, VANCOUVER, B. C.

APPLY TO NEAREST OFFICE

Compressed Air Magazine Company
Easton, Pa., U. S. A.

The STEARNS-ROGER Mfg. Co.

OF DENVER, COLORADO

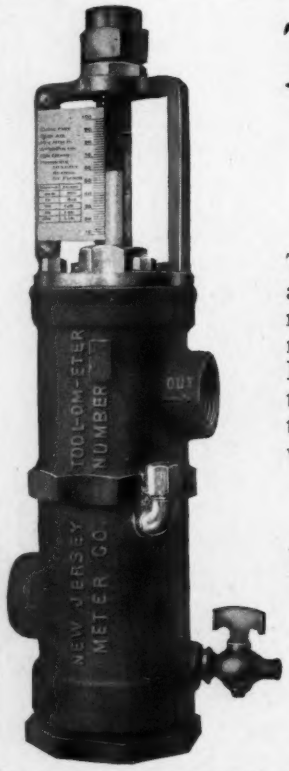
can assist you in securing a substantial bonus payable for the highest grade

Manganese-Tungsten and Chromite

concentrates. These are almost invariably slightly magnetic and by means of

The Wetherill Magnetic Separator

garnets, sulphides or other interfering minerals can be readily eliminated. More ***Wetherill*** machines are being manufactured for this purpose at present than in all previous years combined.



THE TOOL-OM-ETER

The wind bloweth where it listeth
And what do you care?
But COMPRESSED AIR costs money
And the AIR goes WHERE?

This little meter gives you the answer. Shows *at a glance* how much air is used by your sluggers, guns, jacks, japs, giants, rammers, riveters, motors, etc.—when they are new, after a month, three months, before and after overhauling and putting in new parts. Enables you to locate and remove leaks, losses and "air eaters" and to keep your equipment in effective and economical working condition. You can stop losses, decrease costs and increase your output with the same compressor capacity.

"The day of guesswork is past."

Write for further information stating what uses you make of Compressed Air.

ASK FOR BULLETIN 5-A.

NEW JERSEY METER CO.

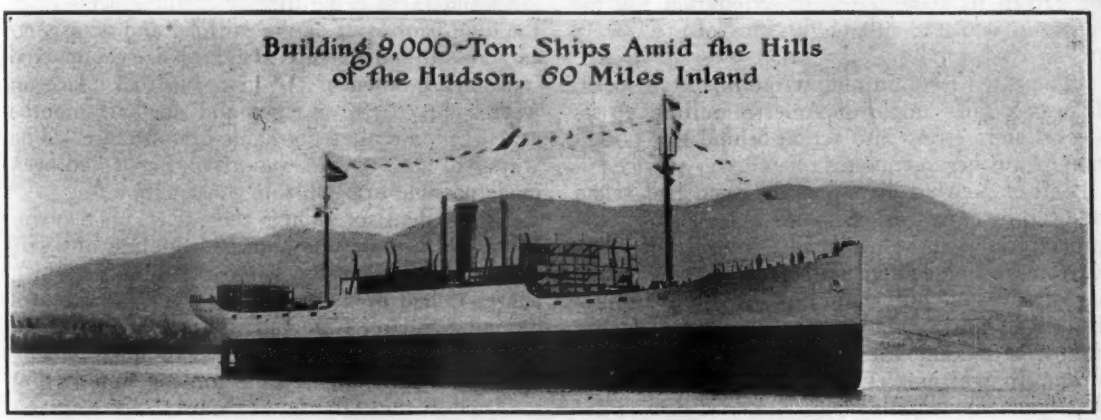
PLAINFIELD, NEW JERSEY

As a matter of reciprocal business courtesy, help trace results

COMPRESSED AIR MAGAZINE

Vol. XXIV JUNE, 1919 No. VI

Air Uses at Newburgh Shipyards Plant



Building 9,000-Ton Ships Amid the Hills of the Hudson, 60 Miles Inland

By FRANCIS JUDSON TIETSORT

SIXTY miles inland from New York Harbor, up the scenic Hudson, between its dimpled expanses of hills where they attain almost to the dignity of mountains, in a 35-acre shipyard encroaching upon the waters of that noble tidal stream, are being built 9,000-ton capacity steel steamships for the merchant deep-sea service of American trade. A spot highly favored by nature, where the last of the proud Mohicans relinquished sadly their favorite fishing and hunting grounds to pioneering white men, it was found a singularly appropriate and convenient place for the construction of giant steel merchant ships.

Hendrik Hudson, explorer-navigator in cockleshells, who sailed 310 years ago up the placid reaches of the stream bearing his name, passing the very cove or widening in the river that now resounds with the rat-a-tat-tat of the air riveter, would be overcome with amazement to see the activities at Newburgh, N. Y., to-day! Another celebrated gentleman with whom the name of the river is appropriately linked, Mr. Robert Fulton, who came along two centuries later with his steam-propelled contraption, the *Clermont,* would doubtless be no less overwhelmed, could he now witness up-river shipbuilding developments in vapor-driven craft. In fact, even Newburgh itself has been pleasurably disturbed out of the even-going tenor of its quiet ways!

Two years ago the ebb and flow of the tides swept into a little bay south of Newburgh on the west bank of the river where there was 25 feet of water. After Irving T. Bush of New York had talked over with engineering and naval architect friends the matter of engaging in a shipbuilding enterprise and had reached a decision, several keen-eyed men journeyed up the Hudson and made notes on slips of paper. They returned to New York with significant reports. As a result hundreds of men began dropping off West Shore trains at Newburgh. The furnished room market in the town took on boom proportions and the community came to realization of having a housing problem on its hands. Six weeks before, the

United States had decided momentously to get into the great European conflict and see it through to a finish. The nation had to have ships, more ships, by the millions of tons. Newburgh found itself suddenly right up on the firing step of the Second Line of Defense.

When 4,000 workmen and their families are dumped rather precipitately into a community of 32,000 souls, all hands have to step lively for awhile. Newburgh began to seethe and boil with activity. Railroad gangs began laying spur tracks; steam shovels plowed into the hill alongside the West Shore Railroad right of way; materials began to arrive by the hundreds of carloads. Before a shipbuilding plant could be built 32 acres of area covered by that 25-foot depth of water had to be filled in and thousands of piles had to be driven to make a secure foundation for the ways on which thousands of tons of steel were to rest.

The town took on almost metropolitan speed. It was a fair sample of America rolling up its sleeves and getting into action behind the 3,000,000 men it began training for military service.

Before Newburgh Shipyards, Inc., had taken on even its outward legal form as a company, the promoters began scouting about the country for air compressing equipment—a commentary on the importance of air equipment in shipbuilding. Building ships without it in normal times would almost be tantamount to a steam engine without steam. In wartimes, when speed in shipbuilding was synonomous with rapidity in riveting and dependent also upon pneumatic tools and many other pneumatic devices, high-grade air compressor equipment was absolutely indispensable.

Meantime hundreds of other plants for shipbuilding and other war industries were confronted by the same situation as regards their air needs; compressor apparatus was at a premium. Machinery men were speculating even in second hand compressors and making large profits.

To give an idea of the extent to which compressed air is utilized in modern steel shipbuilding it may be noted that in the construction of one of these Newburgh cargo carriers there was required the driving of 550,000 rivets, the reaming of 500,000 holes and the calking of 40,000 lineal feet of seams to make the ship watertight.

The embryo company went into the market before its incorporation and bought two large Rand compressors that had seen service at Ashokan Dam on New York City's water supply system. These met the requirements until a later purchase was effected of an Ingersoll-Rand "PRE Type," direct-connected, electrically driven compressor, which now bears the brunt of the load for compressed air requirements at the plant, only one of the old machines being utilized.

Owing to the fact that the compressors were to be installed upon piles and earth fill, the foundations were made much larger than the specifications furnished by the makers called for. This was a wise provision, for scarcely any vibration can be noticed in the Newburgh shipyards power house. In another installation, recently inspected, the usual foundation had been employed with a similar footing of piles and fill and the vibration was so great that the entire power house was visibly shaken.

The work of building the Newburgh shipyards began on June 1, 1917. The 32-acre fill along the river front was accomplished by building a cross-over above the West Shore tracks, rock, sand and earth being dug by steam shovels from the high bank west of the railroad and transported across to the water in standard size dump cars. The laying down of the first ship took place on March 14, 1918, or eight and one-half months afterward, a truly remarkable performance. The ways had not yet been completed, but it had been made possible to begin ship construction.

In less than six months thereafter, on September 2, 1918, there was launched the first of a series of twelve 9,000-ton cargo carriers, for which contracts had been awarded by the United States Shipping Board Emergency Fleet Corporation. This was delivered and accepted complete in December, in the quickest time for any ship of that tonnage on the Atlantic Seaboard. Six ships altogether have been launched since, four of them having been delivered, and four more are on the ways. The last two to complete the dozen, are yet to be laid down, following which steamers are to be built for the Union Sulphur Co. of New York and other private interests.

The vessels now under construction at the Newburgh yard are of the two-deck, three-island type, with two pole masts and one stack. Each mast carries four cargo booms of five tons' capacity, with a thirty-ton boom for handling heavy loads. There is a large hatch to each hold; those to holds, 1, 2, 4 and 5 are 29 feet 3 inches by 20 feet, and that to hold 3 is 18 feet by 20 feet. The crew is berthed in the poop, while the bridge deck enclosure is given over to cargo and the forecastle to storerooms, carpenter shop, lamp rooms, etc. The officers are housed in two houses on the bridge deck, the navigating officers occupying the forward and the engineering officers the after house. These vessels are of the following dimensions:

Length overall.....417 feet 10 inches
Length between perpendiculars.....401 feet

Breadth molded	54 feet
Depth molded	32 feet 10 inches
Designed draft	25 feet 6 inches
Deadweight carrying capacity	9,000 tons
Capacity for grain cargo	476,205 cubic feet
Capacity for fuel oil	1,260 tons
Capacity for bunker coal	1,846 tons
Capacity for feed water	137 tons
Capacity for drinking water	26 tons
Gross tonnage	6,000 tons
Net tonnage	3,783 tons

The vessel is driven by a 17-foot propeller operated by a Westinghouse turbine reduction gear. The turbine is designed for 3,600 revolutions geared down to 90 revolutions of the propeller shaft, giving an output of 2,800 shaft horsepower.

Views at the Newburgh Ship Yards Plant

1.—GENERAL VIEW OF 9,000-TON FREIGHTER LAID DOWN BEFORE YARD WAS FINISHED.
2.—BUILDING A SHIPYARD ON 32 ACRES OF "MADE" LAND ON THE RIVERFRONT.
3.—SIDE VIEW OF GIANT FREIGHTER ON THE WAYS.
4.—VESSEL RECEIVING CAMOUFLAGE DURING THE WAR.
5.—SETTING IN PLACE AND RIVETING DECK PLATES—INTERIOR VIEW.

A rigid specimen trial was that of the S. S. *Newburgh* before her acceptance and transferrence to the Naval Overseas Transportation Service. It was both an endurance and a speed test, her engines running at maximum capacity for twelve hours, of which three hours formed the speed trial. The trial data was as follows:

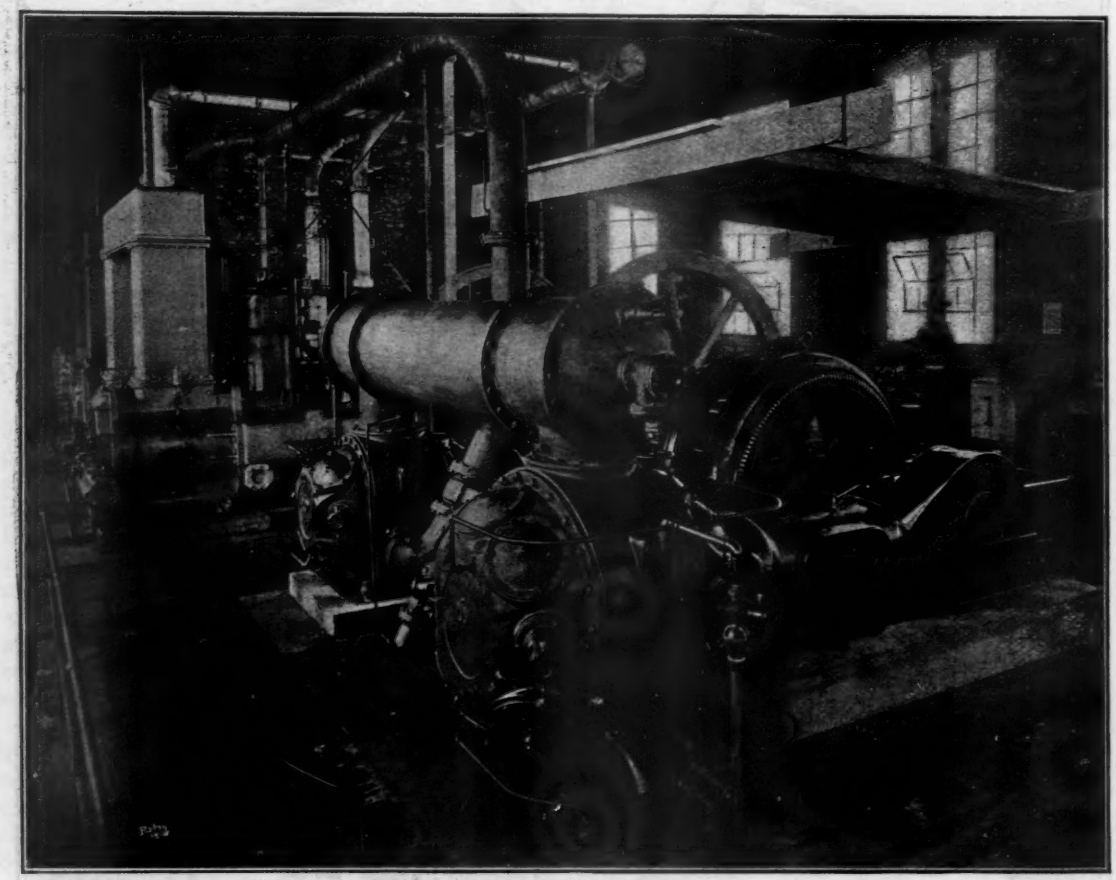
Duration of full speed trial, hours	3
Average revolutions per minute	94.94
Estimated shaft horsepower	35.50
Vacuum, inches	27.4
Fuel oil, pounds per hour per shaft horse power	1.34
Estimated speed, knots	12.4

The *Newburgh* far exceeded contract requirements and proceeded almost immediately on her first voyage to Europe.

The Newburgh shipyards achieved a very high degree of efficiency in riveting, and some fine individual records were made by riveting gangs. The spirit of the men, however, was not to perform the sensational in spurts, but to maintain a high steady average. As at many of the other yards throughout the country, score records were kept on blackboards, and in these records the men took the keenest pride. The good-natured rivalry that resulted had the effect of largely increasing production.

The Boyer and Ingersoll-Rand "Little David" riveting hammers and drills were used in this work, the latter equipment predominating. Supplied by the two steam and one electric-driven Ingersoll-Rand compressors previously mentioned, compressed air at from 90 to 100 lbs. pressure was piped 300 yards from the power house to the men using it. There were 400 men in the riveting gangs, and for six months, up to the time of the signing of the armistice, the Newburgh crews had the highest rating on riveting from the U. S. Shipping Board.

From the very beginning of the work at the



Power House for Newburgh Air Plant

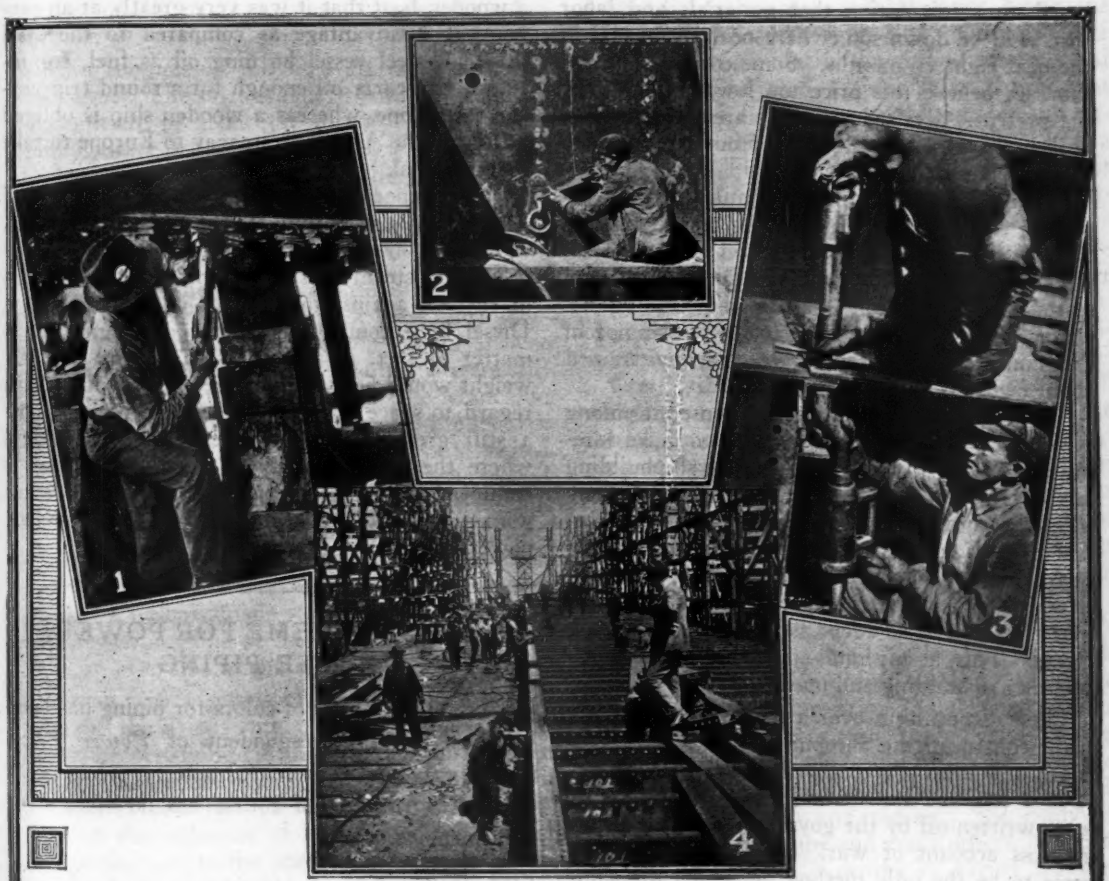
AT THE LEFT ARE TO BE SEEN TWO OLD TYPE RAND AIR COMPRESSORS FORMERLY USED AT ASHOKAN DAM, AND AT THE RIGHT THE NEW INGERSOLL-RAND COMPRESSOR NOW BEARING BRUNT OF THE LOAD.

yard 4,000 men were employed and the Newburgh executives had little or no difficulty, fortunately, in obtaining able-bodied and willing workmen. The pretty town of Newburgh and the shipyard itself, commanding a magnificent view of the up-river scenery, provided a pleasant environment for the workers, who have lived and labored under conditions making for contentment.

The officers and principal active executives of the Newburgh Shipyard, Inc., are as follows: Chairman, Irving T. Bush; President, T. C. Desmond; Vice President and General Manager, E. C. Bennett; Assistant General Manager, H. W. Sweet; Assistant Treasurer, H. G. Mullen; General Superintendent, James Mitchell; Naval Architect, James Preston; Chief Engineer, Alexander Robinson.

Through the courtesy of Mr. Bennett and Mr. Sweet, the writer was recently afforded an opportunity thoroughly to inspect the plant and to obtain a photographic record of what has been accomplished in "tall-water" construction sixty miles up the Hudson. The accompanying illustrations for this article will give a more graphic understanding than words of description.

Newburgh is to become a permanent yard and



Compressed Air in Shipbuilding

1.—RIVETING ON A KEEL PLATE WITH "LITTLE DAVID" HAMMER.
2.—CHIPPING OFF A BOLT HEAD WITH A "LITTLE DAVID" HAMMER.
3.—RIVETING A DECKPLATE, SHOWING HOLDER-ON BENEATH.
4.—GENERAL VIEW OF LAST NEWBURGH SHIP LAID DOWN, 4 DAYS AFTER LAYING KEEL.

is to go in for general commercial shipbuilding with the completion of its government contracts. The prospect for it in the next few years is excellent, for unlike some of the larger yards it will not be handicapped by too big an overhead expense. The present outlook is that the very large plants will be obliged to employ considerable ingenuity in reorganization and management in order to "break even" on private contracts.

Mr. Hurley and others have talked recently of shipbuilding at $150 a ton after government contracts have been completed, as against a war price of from $250 to $270 a ton, which is, of course, prohibitive in peace times. Vessels at $150 are based on a calculation that materials and labor costs will be down somewhere near to normal in the next eighteen months. Some construction authorities believe this price too low, certainly for the present. Revised estimates are that shipping will build at about $160 in from one year to eighteen months hence.

Meantime shipbuilding mechanics will be acquiring efficiency at their exacting craft. During the war green men were drilled in classes for six weeks and then put at work in gangs with more seasoned workmen, but a skillful shipbuilding mechanic cannot be turned out in six weeks, nor in six months. The Newburgh company trained about eighty per cent of its men.

The feeling at Newburgh, as I sensed it among the executives, is that it is not safe to make forecasts regarding the future of private shipbuilding in the United States until it is known definitely what the course of the Shipping Board is to be. There will be uncertainty while the Shipping Board remains in control of ocean shipping rates, in which it is not to be expected that the board's operatives can be so adept as are private shipping agents. This, at any rate, appears to be the sentiment in shipbuilding and maritime circles.

There is optimism over a likelihood that craft in the control of the Shipping Board will be auctioned or sold to private owners at a price around $150 a ton, the remainder of the wartime cost being written off by the government to the profit and loss account of war. At this writing this seems to be the only method by which the shipping situation can be adjudicated practically.

Mr. Hurley's $150-a-ton price theory, which merely as an idea may be revised later, of course, has had the effect of knocking in the head a good many private construction contracts that had been pending at somewhat higher prices. Prospective owners of bottoms naturally do not want to make a contract as long as there is any possibility that they can get vessels at $150 a ton, remote though that possibility may be. Many large private shipbuilding deals are afloat in the market at this time, but they cannot come to anchor in the various yards until the matter of price is settled.

I asked Mr. Sweet at Newburgh what he thought of the possibility of salvaging ships sunk by submarines during the war.

"I'll lay you a wager," he replied, "that not ten per cent of them will be recovered."

Mr. Sweet took the steel shipbuilder's view that wooden ships could not make any headway against steel vessels in economical competition and advanced some good reasons for his stand. Considering construction alone he made the point that there was such a pronounced space wastage in a wooden boat that it was very greatly at an economical disadvantage as compared to the steel ship. A steel vessel burning oil as fuel, for instance, can carry oil enough for a round trip voyage to Europe, whereas a wooden ship is obliged to stop at the Azores on its way to Europe to take on more coal.

We touched on the matter of oil for fuel and Mr. Sweet saw nothing for it in the future but the heavy oil engine ship, because an oil burner producing steam uses by weight only two-thirds of fuel oil against three-thirds of coal. With a Diesel high compression heavy oil engine, as a matter of fact, in a motor ship, the oil used by weight would be as one to three with coal. With regard to space occupied for motive power plant a still greater economy is effected by builders where the low compression heavy oil engine is employed for the propulsion of the ship. We are witnessing only the beginning of the oil engine power plant in the maritime field.

COLOR SCHEME FOR POWER HOUSE PIPING

The following list of colors for piping has been prepared by a correspondent of *Power Plant Engineering* and is presented here for whatever it may be worth. It of course has no official endorsement:

Live steam	Yellow
Exhaust steam	Black
Compressed air	Dark green
Hot water	Dark blue
Cold water	Light blue
Returns (condensation)	Gray
Fire service water	Maroon
Ammonia	Brown
Brine	Light green
Oil	Purple
Hot water heating	Pink

Harnessing the Air in Ancient and Modern Times

By CHARLES AUSTIN HIRSCHBERG

AIR, bounteously supplied by Nature and so essential to the very existence of all species of life, has like many other things been appropriated by man to impart life to many mechanical contrivances which are exercising an extensive influence on mankind's manner of living—the things we eat, the clothes we wear, our shelter and our amusements. Even modern warfare depended largely for its terribleness upon the diverting of air by man from Nature's intended purpose.

Man compressed and used air many hundred years ago. The story is older than that of Christianity itself, by about 350 to 400 years. It was contemporaneous with many ancient and long dead civilizations. It is, in fact, the oldest known motive power, exclusive of the beast and man, wind and water contrivances, so familiar to the olden days.

Alexander The Great was still undergoing his education under the tutelage of Aristotle; Persia had just attained the height of its ancient civilization; the teachings of Confucius were still comparatively new in the Land of the Manchus; Roman history was just starting, and the scourge of Attila and his Huns had not yet been visited upon the world, when the story of compressed air was first written. We read that Ctesibius of Alexandria invented an implement for war, consisting of a tube out of which an arrow was shot by the compression of air; that Heron, a pupil of Ctesibius, made various experiments with compressed air, one of them being the sustaining of a jet of water in the air.

Heron was a genius in his day, much sought after by the priests of the temples, who enlisted his aid in mystifying the ancients and causing them to believe that the priests were invested with supernatural powers. Heron applied his knowledge of the influence of heat in expanding and contracting air, to the opening and closing of the temple doors, to the blowing of organs, and in the form of the bellows, to the kindling of intense fires.

A hollow altar containing air was heated by a fire kindled on it; the air in expanding would drive some of the water, contained in the spherical vessel shown beneath the altar, into a bucket, causing it to descend and open the temple doors by turning a pair of vertical posts to which the doors were fastened. When the fire was extinguished the air would cool, the water would leave the bucket and the doors would close. So much for the ancient story.

The modern story of the first commercial work to which compressed air was applied is not very old; scarcely 70 years, as man measures time. Innumerable innovations in scientific mechanics have been developed in this comparatively brief period, such as the telegraph, the telephone, wireless, the great compound locomotive, the incandescent light, the rotary printing press, flying, the submarine, the automobile, and scores of other major inventions that no longer surprise most of us. All are of such a spectacular nature that they have not failed to produce wonder and admiration in the thoughtful—they have left a vivid impression on our minds, and yet none of them can claim a more beneficial or more lasting influence on man's welfare than can the uses of compressed air, which, working in comparative obscurity insofar as the masses of population are concerned, have performed and are still accomplishing tasks admittedly insurmountable by other means.

Few perhaps are aware that the coal with which we heat our homes is extracted from the earth by means of compressed air—that coal by-products, supplying the leavening agent for our bread, and the gas with which to bake it, the wherewith for dyeing our clothes, the basis for many of our medicines and many other things too numerous to mention, depend upon compressed air for their existence.

Compressed air pumps the water we drink, supplying it free from sulphur and other impurities. It acts as a transfer agent, handling acids and other chemicals, eliminating the element of danger to the person from many of our employments.

Compressed air mines our precious ores and gems—iron, copper, nickel, tin, zinc, lead, silver, gold, platinum and radium; the diamond, the turquoise, the ruby and many others. Not content to stop there, it works in varied ways to bring them to that state where man can apply them to the useful arts; it turns the metal into ships, buildings, bridges, locomotives, steel cars, automobiles, etc.

It cleans and renovates our houses, rugs, clothes and furs. It does our painting, it sprays our trees and shrubbery. It builds our roads, tunnels and subways, it brakes our cars and trains, making them safe for millions of folks to travel upon. The late George Westinghouse, who invented the air brake, was laughed at when

he proposed to "stop a train with wind," and yet his epochal invention has proved to be one of the most important elements entering into the success of modern railroading.

Compressed air quarries our stone, and dresses it, so that we may pave our streets, face our buildings, build our monuments and trim our houses to stand through the ages as a testimonial of the industry of bygone generations.

The skyscrapers of New York owe their existence to compressed air. Such buildings weighing thousands of tons must rest on solid foundations—compressed air is the agent employed in sinking these foundations, to say nothing of its welding the thousands of rivets that bind securely their steel frame work.

Compressed air carries our mails, returns to us our change when we go shopping, pumps oil wells and conveys oil through pipe lines. It blows our cupolas and furnaces, enabling man to melt and mold metals into any desired shape. In fact, the story of harnessing the air is well nigh an unending one; name any industry and you will find compressed air there, faithfully serving mankind.

THE ATLANTIC FLIGHT

The seaplane and airplane flights across the Atlantic, which were centering the attention of the entire world, as the June issue of COMPRESSED AIR MAGAZINE went to press, had for two years been unsafe topics on which to base any predictions. Curiously enough it had appeared to be risky to say what could not be done rather than what could be accomplished. It was unfortunate that the Navy dirigible was blown away from her moorings at Newfoundland and lost at sea, after her first fine flight from Montauk Point to Trepassey Bay, for here was lost an opportunity to compare her prospective performance with that of a trans-ocean airplane.

It may at least be safe to consider a little of the actually reliable and up-to-date information which has been made accessible.

Contrasting the airship and the airplane, it is found that with fuel carried 30 per cent of the gross weight of the machine, the ship has over three times the flying radius of the plane. This is due to the greater tractive force in proportion to weight needed by the plane than by the ship, and the moderate speed at which the airship can travel, thus reducing head resistance. The limit of a continuous flight is estimated at 1136 miles for a plane and 3430 miles for a ship under the supposed conditions.

Lanchester estimates that with a plane designed to reduce resistance to a minimum, a flight of 2000 miles might be made by a plane. As this is about the distance across the Atlantic Ocean, the conclusion is a non-stop trans-atlantic flight will only be made as a freak performance, and cannot be reduced to a regular traffic. A regular route must have at least one calling station for taking on fuel.

Further, as the atmospheric drift is always easterly, even if a continuous flight from America to Europe is made, return flight will be unattainable on account of the wind resistance.

For such air craft as would be suitable for over sea traffic, the figures are given as follows:

Airplane—Weight, 8 T.; speed 90 miles per hr.; power, 1200 hp.; fuel, 3.5 T. Running at 1000 hp. and 0.5 lb. fuel per hp. hr., will use 500 lb. an hr., and can fly 14 hr.; distance, 1260 miles. Atmospheric drift, 30 miles per hr., or 420 miles in 14 hr., hence flying east the trip could be 1680 miles.

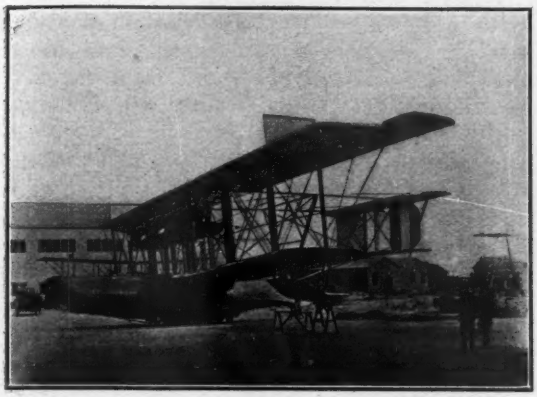
Airship—Weight, 60 T.; speed, 65 miles per hr.; power, 1500 hp.; fuel, 17 T. Using full power, fuel per hr. will be 750 lb., and can travel 45 hr.; distance, 2925 miles.

These figures would indicate that the airplane cannot, ordinarily, make a non-stop crossing of 2000 miles, while the airship might easily do so, even allowing for moderate adverse winds. If, however, the head wind rose to 40 miles per hr., it is doubtful if even the airship could make a non-stop crossing.

To show the jump from past performance in order to accomplish trans-Atlantic flight, the record for non-stop flight and perhaps the nearest to a trans-oceanic flight, was the trip London to Constantinople and back to Saloniki, when the cruiser Goeben was bombed, the distance covered being over 2000 miles and the time 31 hr. The plane was a Handley-Page with 100-ft. wing spread and 275 hp. and carried five men.

Data is not available as to performance of airships, as these have, for the most part been of German development, but it is understood that a British ship is nearing completion which has an estimated endurance of 211 hr. at 45 miles per hr., which would give a flight of 9500 miles, and that the 1918 German Zeppelins showed 177.5 hr. at 45 miles per hr., or a trip of 8000 miles. These are newspaper reports and to be taken with a grain of salt, but even with 50 per cent deduction, these aircraft should negotiate the trans-Atlantic trip easily. From St. Johns, Newfoundland, to Ireland is 1860 miles, and to the Azores is 1195 miles; from the Azores to Lisbon, 850 miles more.

A Navy "Nancy" Seaplane



(Copyright, Keystone View Co.)

This is the "NC" type of seaplane used by the United States Navy in flying from Long Island to Newfoundland and across the Atlantic. These giant planes have a wing spread of 120 feet and are propelled by four screws driven by as many Liberty motors of 400 h.p. each. They have carried 50 passengers with ease and can rise into the air weighing 14 tons, including load and make 65 knots per hour. When not heavily loaded and going at full tilt these heavier-than-air-craft can negotiate about 100 knots per hour. They can start from and alight in the water in a moderately rough sea.

INSECT PARALYZES AIR BRAKE

A motorman with excellent previous record had a collision with considerable damage. He insisted that the brake and not he was to blame. The entire braking system of the car was carefully inspected and tested and pronounced all right. The car was returned to service, but after several weeks there was another accident, and after taking everything apart, as narrated in *Electric Railway Journal,* the trouble was discovered.

In one of the passages of the triple valve there was found a collection of eggs which had been deposited there by an insect and were developing. As they spread out and grew larger, the air passing through the passage blew them into one of the ports of the triple valve. This became choked and caused the slow application of the brakes. The action of releasing the brakes, or of another application cleared the obstruction so that the equipment operated properly. Operation continued to be satisfactory until additional eggs were developed so as again to choke the port of the triple valve and prevent the passage of air.

DUCTILITY OF PLATINUM

The marvelous ductility of platinum may be conceived when we consider that out of a single Troy ounce of the metal it would be possible to make an almost infinitely slender wire that would reach from Santiago, Chili, across the continent to Rio de Janeiro, a distance of about 1,800 miles. To draw out platinum into so exceedingly fine a wire it is covered with a thin layer of gold. This new wire is drawn to the thinness of the former one and the gold is dissolved.

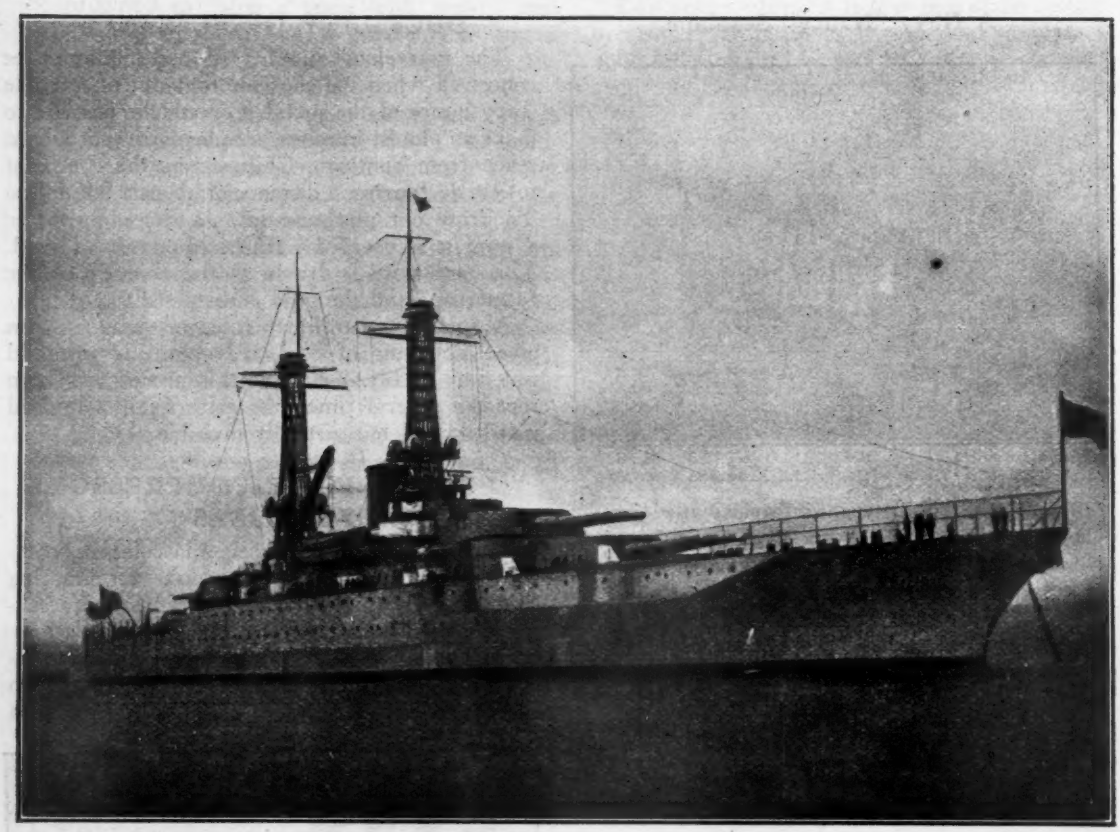
A small section of this second wire is then given a coating of gold, redrawn, and the gold covering dissolved. After this process has been repeated several times, the wire finally obtained is still intact, but virtually invisible.

PORTABLE AIR COMPRESSOR FOR TIRES

The halftone shows a neat and compact, portable, electric driven air compressor for inflating tires, made by the Block & Decker Manufacturing Company, Baltimore. The pressed steel receiver, 14 by 30 in., holds sufficient air, it is asserted, to inflate five average tires from flat to full pressure, or ten tires from 40 to 80 lb., which

PORTABLE AIR COMPRESSOR FOR TIRES

of course depends upon the pressure to which the receiver is charged, and this is not stated. The compressor is operated by a ½ h.p. motor. Motor, gear train and compressor are enclosed in one housing, the motor and compressor being cooled by forced circulation of air. Motor, gears and compressor are grease lubricated.



(Photo copyright, Keystone View Co.)

The U. S. S. Idaho, New Superdreadnought

This photograph shows the Idaho, a late addition to the navy, and one of the most powerful fighting ships in the world, riding at anchor in New York harbor. Under date of May 5, the Bureau of Construction and Repair of the Navy Department wrote the editors of COMPRESSED AIR MAGAZINE regarding the uses of compressed air on board these modern ships of war. Connections are provided at the guns for the purpose of ejecting gases generated from partly burned powder before the next charge is entered. Connections are also provided within the conning tower for expelling accumulated gases, or gases that might accumulate in battle. Compressed air, as is well known, is also used for charging torpedoes, as well as discharging them from the tubes. Ships carrying fuel oil are provided with connections in each tank, for the purpose of blowing oil from one tank to another.

In addition to the above, compressed air is furnished to the various workshops for the operation of pneumatic tools. On the fuel ship *Maumee,* which is fitted with Diesel engines, compressed air is used for the operaton of the steering gear. On big battleships such as the *Idaho* compressed air motors are installed as a reserve means of operating the hydraulic steering gear which primarily is operated by electric motors. It is also used for testing the water tightness of compartments.

TO TEST AUTOMOBILE COMPRESSION PRESSURES

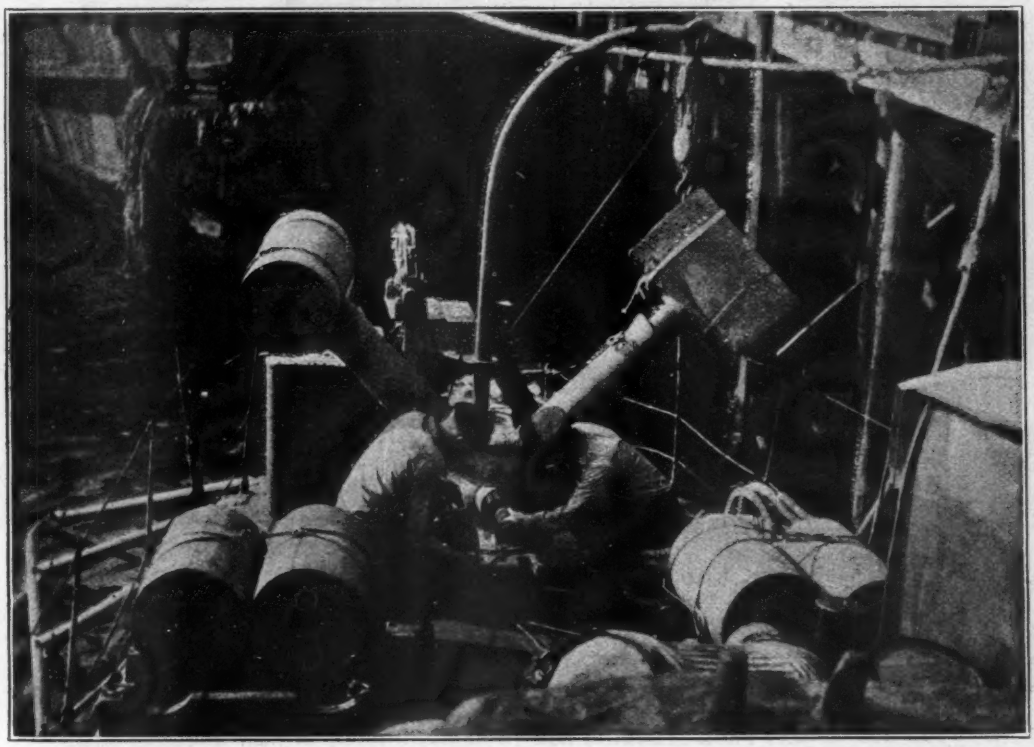
One of the most common causes of lost power in an automobile is that the force of the explosion pressure depends upon compression pressure before the gas is ignited. If the compression is 80 pounds, the explosive force acting against the piston top and imparting power to it will be about 400 pounds per square inch. If worn piston rings or leaky valves allow gas to escape when the piston is rising on its compression stroke, the resulting decrease to 50 or 60 pounds means a reduction of explosive pressure to about 300 pounds per square inch. Besides this diminution in pressure, there is a loss due to further leakage through the faulty retaining members. It is suggested by the *Scientific American* that a simple compression pressure indicating gage may be made by taking an old spark plug body, from which the porcelain has been removed and fit in a valve

from a discarded inner tube by pouring melted babbit metal or solder in to fill the space between the spark plug shell and the valve. When the metal has set, the valve is found to be firmly imbedded in the soft metal. The spark plug is removed from the cylinder to be tested and the combination plug body and valve stem put in its place. As the engine is turned over briskly by either the hand-crank or self-starter by an assistant, or the engine run slowly on the other cylinders, a tire pressure recording gage held against the valve will record the compression pressure just as it does air pressure inside a tire. If the pressure is low on all cylinders it is a good indication that the entire engine needs attention. You can determine whether the compression is adequate by comparison with the same tests on a new car of the same model.

AN AIR COMPRESSOR SPEEDS UP THE AIRPLANE

A French engineer, Auguste Rateau, has invented an altitude compensation device for airplane motors. The invention comprises an arrangement by which the exhaust from the engine is made to drive a small turbine which compresses up to at least normal pressure the air drawn into the engine so that, no matter what the altitude, full power will be developed. It is stated that a heavy day bombing machine, whose speed at 15,000 feet did not ordinarily exceed 80 miles an hour, made 140 miles an hour when fitted with the Rateau device.

Milton H. Smith has been re-elected president of the Louisville & Nashville R. R., with headquarters at Louisville.

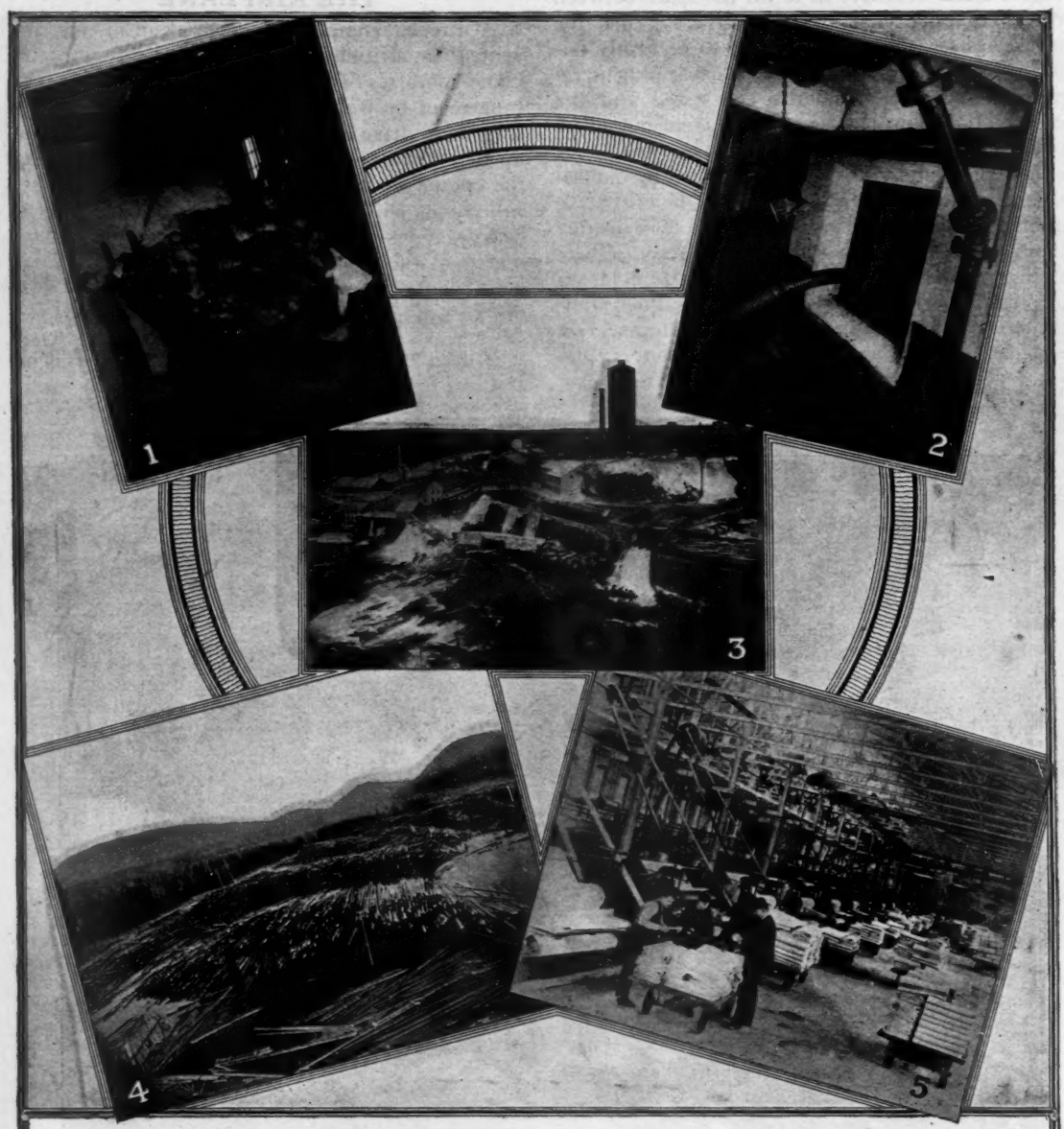


(Photo Keystone View Co.)

The Device that Ended Germany's U-Boat Operations

Here is shown the death-dealing depth bomb, or "ash can," as it was called by the gobs, and the "Y-gun" method of propelling two of them overboard simultaneously. At first depth bombs were merely tipped off a rack over the stern of a destroyer, but this was found an inconvenient and hazardous makeshift. The recoil gives a down thrust from the Y-gun, but no side thrust. By means of a regular gun breech lock, into which gunners are seen placing a charge in the illustration, a blank three-inch shell is exploded, which propels the two bombs from the gun chambers to a distance of about 30 yards from the ship. The charges, it will be noted, are lashed to T-shaped iron plungers which go overboard along with the bombs. Used by the British and American naval forces these ash cans accounted for a majority of the 205 submarine raiders destroyed during the war.

Compressed Air in the Paper Making Industry



(Photos copyrighted, Underwood & Underwood.)

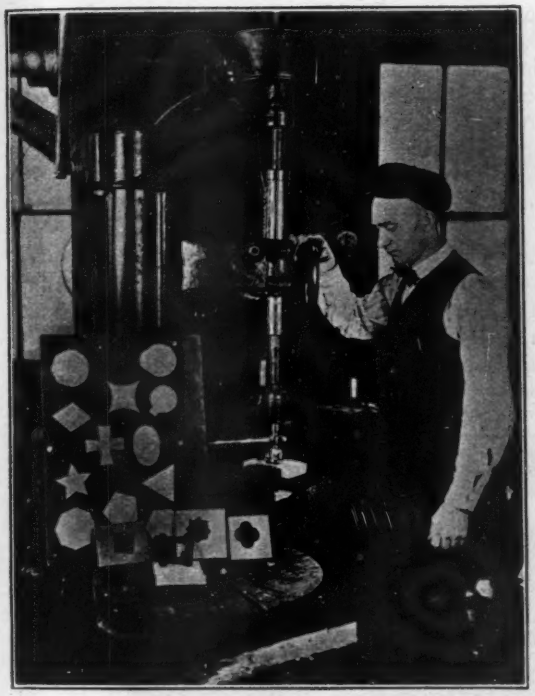
1.—WOOD BOX ON WAY FROM STEAMING BOX TO BARKING DRUM IN NEW ENGLAND MILL.
2.—DRAINING PULP VAT WITH SUCTION PIPE IN A BANGOR MILL.
3.—GENERAL VIEW OF A GREAT PAPER PLANT AT FORT EDWARD, NEW YORK.
4.—RESERVE SUPPLY OF SPRUCE FOR A PAPER CONCERN IN NEW YORK STATE.
5.—FIRST STEP IN THE PRESSING PROCESS. PULP PASSES FROM SCREENS AT LEFT TO PRESSES IN CENTER, WHICH EXTRACT WATER AND TURN OUT THICK SHEETS FROM WHICH PAPER IS MADE.

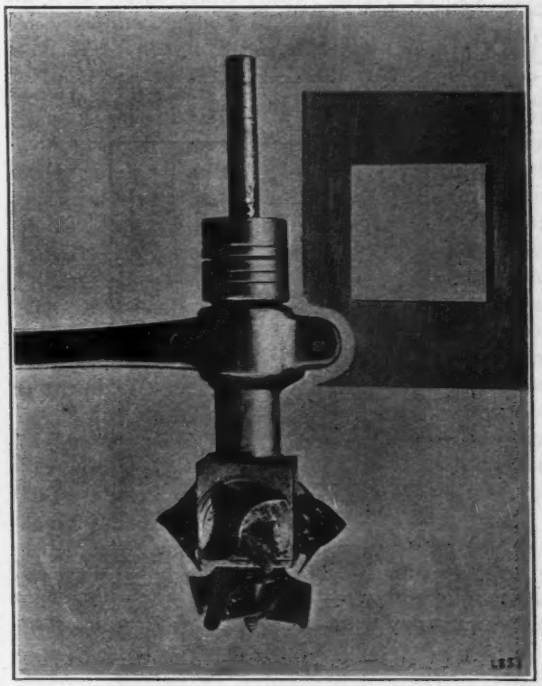
The following are uses for compressed air in a representative modern paper mill as compiled by M. C. J. Billingham in *The Paper Industry*:

Forced draft under boiler furnaces.
Induced draft in smoke stack.
Pneumatic coal and ash handling systems.
Pneumatic soot blowers.
Cooling systems for electric generators.
Air lifts for pumping water.
Hot air heating systems.

Forced ventilating systems.
Absorption systems to prevent condensation.
Absorption systems for expediting drying.
Absorption systems for drying coated paper.
Cooling systems for calender stacks.
Vacuum for suction boxes and for suction rolls.
Suction on plate screens.
Air hoists for handling paper rolls, etc.
Dust collecting systems in the dusting room.
Blower systems for washing filter beds.
Blowers for removing stock from cylinders.
Vacuum systems for sweeping the mill floors.
Portable compressors for cleaning motors.
Pneumatic tube systems for conveying written orders to the various departments.
Compressed air to assist in washing pulp.
Compressed air for agitating pulp, bleach, etc.
Blower systems for conveying sorted stock.

Mr. Billingham has indicated more than two dozen uses for compressed air in actual practice today in paper mills. Some of them are of minor importance, while others are vital. Nevertheless there is indicated a wide range of adaptations and possibilities, which are by no means exhausted. The use of air generally in the making of paper is still in the development stage and it is predicted that within a short time every paper mill will have its air piping system to convey compressed air to every part of the plant, such system becoming just as essential as the steam or water piping systems.





(Photo Keystone View Co.)

Rotary Drill that Makes Square Holes

After fourteen years of work C. H. Schmidgall, of Peoria, Ills., has become the patentee (Patent No. 1,297,740) of a device that was considered a mechanical impossibility until two years ago. Mr. Schmidgall has evolved not only a bit that will drill a square hole but all the other shaped holes shown in the picture above. The picture at the right gives a close view of his remarkable invention.

It was reported from Paris on May 10 that the French aviator, Sadi Lecointe had established the previous day what was believed to be a new height record for a monoplane by climbing 26,900 feet, or five miles skyward. He was accompanied by a representative of the French Aero Club, so the feat appears to have been authenticated for purposes of permanent record.

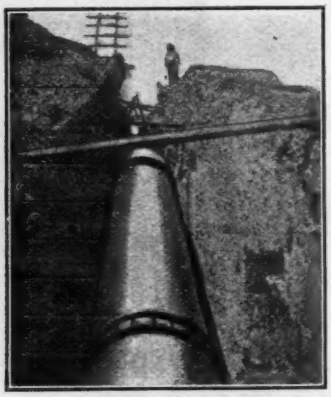
It was made public in New York recently that a woman of thirty-five who had been overcome by gas leaking from a defective jet in her home, was restored to consciousness and her life saved after Dr. Harry Rammol, an interne at Fordham Hospital, had operated a pulmotor continuously for seven and one-half hours. The case was remarkable, not alone because of the heroism of the physician's tireless work to save a life, but because as a rule a patient's heart does not stand the strain of gas poisoning and the injection thereafter of large quantities of oxygen into the lungs. Usually the shock proves fatal.

Survey of the Technical Field

Edited by FRANK RICHARDS

LARGEST GAS LINE IN U. S.

What is reported to be the largest gas line in the United States, which must mean also the largest in the world, is just being completed for the Carnegie Natural Gas Company. It is to convey gas from the coke plant of the Clairton Coke Works to the Duquesne, Homestead and



PIPE IN DEEP TRENCH.

Edgar Thompson steel mills. The line has a maximum diameter of 40 in., is 11 miles long,

ROUNDING SHARP CURVES.

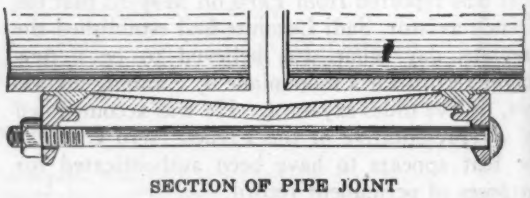
has a a daily capacity of 70,000,000 cu. ft., and is capable of sustaining a pressure of 200 lb. per square inch, although it will actually work under a pressure of from 30 to 50 lbs.

All these particulars make the installation of special interest to all who may have to do with the large transmission of compressed air. The line passes through a hilly country, the curves, both horizontal and vertical, being numerous and it is laid partly under ground and partly upon concrete piers above the surface, as seen in the illustrations here reproduced from *Engineering News Record.*

The pipe used is of the lock-bar type, with plain ends. The uniform thickness, for all sizes from 30 to 40 in. is 3-8 in. There are 38,081 ft. of 41 in.; 12,381 ft. of 36 in. and 7881 ft. of 30 in. It was necessary to use riveted pipe in certain special sections for very sharp curves and for a riser which was required at a bridge.

PIPE LAID ON CONCRETE PIERS.

The joint used is of the Custer type, with rubber gaskets, and where the curves are of large radius the play allowed by the flexibility of these joints is sufficient to make the turn. The de-



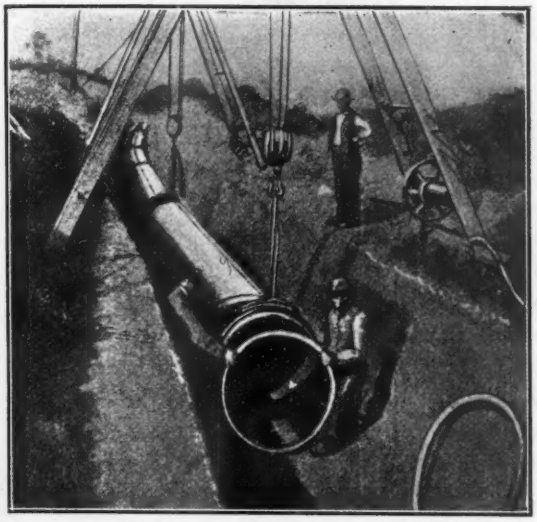
SECTION OF PIPE JOINT

sign of the coupling is shown in the sketch. The buckle-plate sleeve which abuts against the rub-

ber gasket allows for an opening of from 1 in. to 1½ in. on the outside of the curves, while still maintaining a gas-tight joint. By proper beveling a curve of 133 ft. radius was laid. To round this curve, which is shown in the illustration, six 17 ft. lengths, beveled 2½ in. each end were used.

PIPE LAYING AND JOINING

It is not necessary to speak here of the trench excavation and other preparations. After the delivery of the pipe the laying is accomplished by means of tripods supporting block and tackle operated by a winch. After lowering the pipe



LOWERING PIPE AND ADJUSTING JOINTS.

into the trench and adjusting the joint, the back tripod is moved forward, while the forward tripod supports the end of the pipe until the insertion of the next length. In adjusting the joint the back ring is first put upon the pipe, and the rubber gasket, which fits snugly against the pipe, is snapped over it and pushed back to position in the ring groove. The buckle-plate sleeve is next inserted, after which the next length of pipe, with the forward ring and the rubber gasket already in place, is inserted in the sleeve. The ring-bolts are now placed and the nuts tightened temporarily. A 3-8 in. clearance between the ends of the pipe is allowed for expansion. After temporary placing and tightening of the bolts an auxiliary gang follows and completes this tightening, which presses the buckle-plate in against the rubber gasket, making an air tight joint.

The T. A. Gillespie Co., of New York, was the contractor for the construction, and the lock-bar pipe was furnished by the East Jersey Pipe Corporation.

LIQUID OXYGEN EXPLOSIVES

It is not easy to believe that there can be any great future for liquid air or liquid oxygen for high explosive service. The impossibility of preventing the rapid evaporation of the liquid seems to be hopelessly fatal to its general employment. Nevertheless the subject still entices the persistent inventor and quite respectable results are recorded. *Le Genie Civile* has compiled the latest information upon this topic, and it cannot fail to be of interest to our readers.

Military necessity compelled the German authorities to requisition the entire stock of nitric explosives. Coal mines, potassium mines, stone quarries, etc., which used large quantities of these explosives were compelled to look for some substitute. This was a favorable occasion for German engineers, who for about 15 years had worked on the problem of oxyliquit, to give their products a trial in the industry. The principle of this explosive is entirely different from those upon which all the others are based. Industrial or military explosives are generally substances containing two essential constituents, a combustible element, carbon, and an ignition element, oxygen. The explosion is the result of the abrupt and violent combination of these two elements. Oxygen is introduced under the form of nitric combination or chlorinated combination; carbon in form of organic matter. With oxyliquit the liquefied oxygen is put in contact with carbon in a divided and porous form. Under a system of ignition, the combination takes place with explosion.

Liquid oxygen is always produced on the spot where it is to be used, as it is impossible to prevent volatilizaton taking place shortly. It is prepared by liquefying the air, the resulting mixture of liquefied nitrogen and oxygen, being submitted to a partial distillation, which eliminates the larger part of the nitrogen, more volatile than the oxygen. The so obtained bluish liquid contains about 85 per cent of oxygen.

A German Society for the exploitation of the Linde patents is said to be able to furnish installations giving an hourly output of 23 lb. of liquefied rectified oxygen. The liquefied oxygen is transported from the place of production to the place of utilization in special containers.

Two methods of using the liquid oxygen for blasting purposes are employed. By the "Kowastsch" method the liquid oxygen is poured upon the lampblack in the bore-hole. A cylindrical cardboard cartridge the same diameter as the hole contains the lampblack or other porous material rich in carbon. It is closed at both ends with cardboard or cork. Two small tubes of thin cardboard pierce the stopper at the outer end.

These tubes serve for the pouring of the oxygen also for the fuse or electric ignition system. A metal rod is inserted in each tube to prevent them being crushed, the cartridge placed at the bottom of the hole and packed with a wad of clay. The metal rods are then extracted and the liquid oxygen poured in by means of an elbow funnel. The explosion is comparable to that of dynamite.

The "Marsit" method allows of a more regular working and is therefore more in use than the other.

In this the cartridge is saturated before being introduced in the bore-hole. To do this the cartridges are immersed in a special vessel of cylindrical shape with double walls, filled with liquid oxygen. The cartridges are left first exposed for a few minutes to the vapors above the liquid, to cool them off, then completely immersed for half an hour. The saturation is therefore complete. When the cartridge is saturated, it is taken out, and the ignition system attached as quickly as possible; it is then placed in the bore-hole and tamped. The manipulation in this method is far simpler than in the first mentioned, the only inconvenience being the unavoidable delay between the taking out of the cartridge and the placing in the bore-hole. During the lapse of these few minutes a certain part of the oxygen of the cartridge evaporates. To lessen this loss, and to keep in the lampblack a sufficient excess of oxygen, the walls of the cartridge are made watertight; they are of corrugated cardboard. No detonator is needed to explode these cartridges, this being one of the advantages of the new method; all that is necessary is a small primer ignited by a fuse or by electricity.

The principal company manufacturing this product, the "Sprangluft Ges. m. b. H.," of Berlin, claims to have delivered each year an equivalent of 10,000 tons of nitric explosives. Even allowing for probable exaggeration, that shows how widely this product is used in Germany.

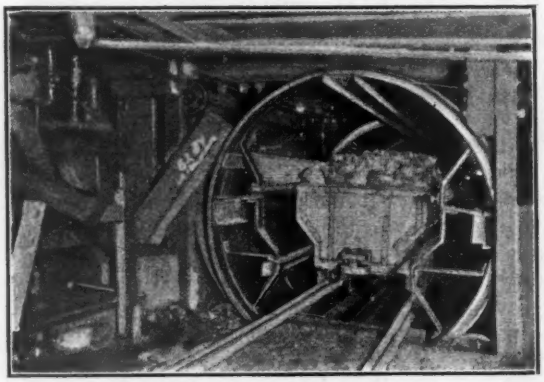
The greatest advantage of oxyliquit is that it almost entirely eliminates the danger of accidents. The cartridge itself is only explosive for about 10 minutes, between the time of its saturation and the time of its ignition. During this time the danger is not any greater than with any other explosive. The result of this advantage is that in case of a miss, it is only necessary to wait half an hour for the cartridge to become entirely harmless, and so to be able to uncover the bore-hole without any danger. In addition, all danger inherent to transportation and storage of the explosive is entirely eliminated.

The method, however, has its disadvantages. The principal is, that it is impossible to store liquid oxygen, thus requiring a liquefaction and rectifying plant at the place where it is used. Also there is need of very experienced hands for a quick charging of the boreholes.

Theoretically, the new explosive may claim superiority. In practice, however, it gives an explosion hardly equivalent to the most powerful explosives known, the common dynamite and the gelatine dynamite.

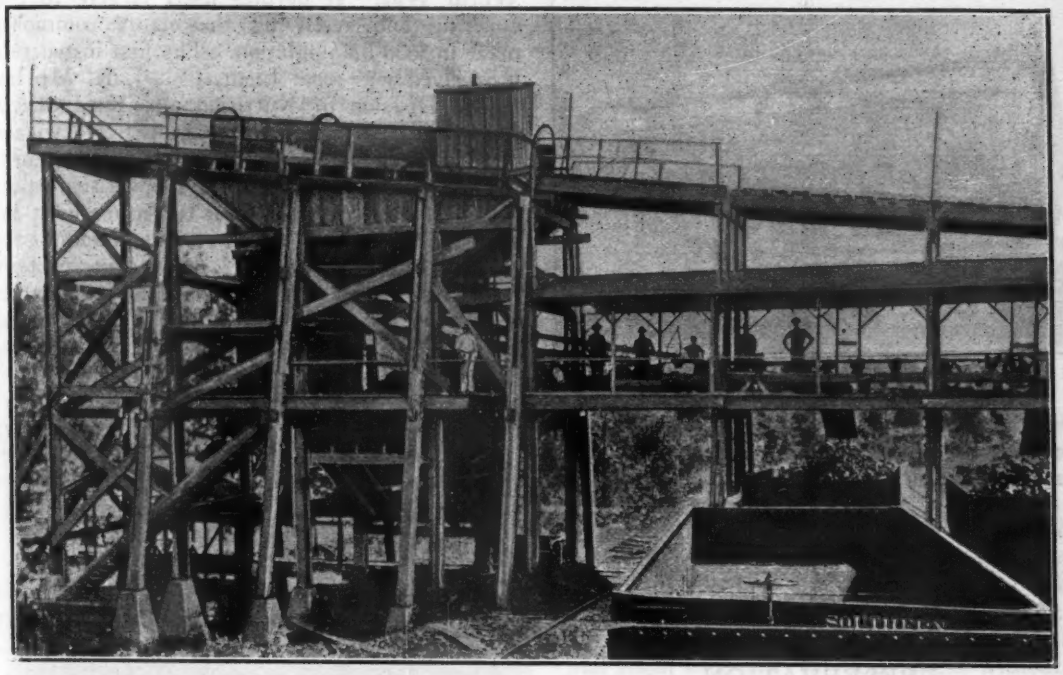
THE WOOD ROTARY PNEUMATIC DUMP DESCRIBED

We have at different times shown in COMPRESSED AIR MAGAZINE quite a variety of devices for dumping or unloading cars by means of compressed air. These devices have generally been embodied in the construction of the individual car and have added greatly to its cost and maintenance. With the arrangement here shown, used chiefly for mine cars, the car itself is reduced to its simplest terms. There are no doors or hinged bottoms or sides to be opened or any other contrivances.



CAR IN CAGE READY TO DUMP

The cars, either singly or several at a time, are run into a revolvable cage built into the track at the dumping place, and then by rotating the cage the car is turned over bodily and its contents



Three-Car Dump on Incline Delivery

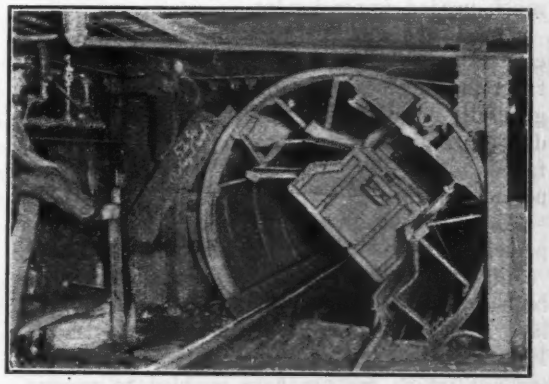
VIEW INDICATES METHOD OF DELIVERY TO TRAVELING CONVEYOR AND STANDARD RAILROAD CAR BELOW.

are dropped. The cage consists of large steel rings within which are the track for the car with the necessary guides, including overlapping projections which catch the body of the car when the rolling over occurs. The large rings are supported by flanged wheels mounted on roller bearings.

The dump is operated by two long air cylinders with the pistons attached to wire ropes running around the rings. The main cylinder for rotating the dump to unload the cars, and the reverse cylinder for returning the dump to normal position, are both controlled by a simple valve arrangement, placed between the air receiver and the cylinders, at a point convenient for the operator. In some instances the control valve is placed as much as a hundred feet away from the dump; in others it is conveniently located close by. The valve movement is very simple and the entire arrangement is so designed that any ordinary track man or driver can learn to operate the dump with very little instruction, as the cylinders are so connected that the arrangement is practically fool-proof in its working methods.

The admission of air to the main cylinder may be slow or rapid, as desired, and the speed may be varied during the rotation of the dump by simply moving the handle of the master valve. At the end of the stroke the cylinder is air cushioned, in both forward and return motions. This arrangement not only protects the car and the dump from all shocks or racking, but also assures operation with minimum power.

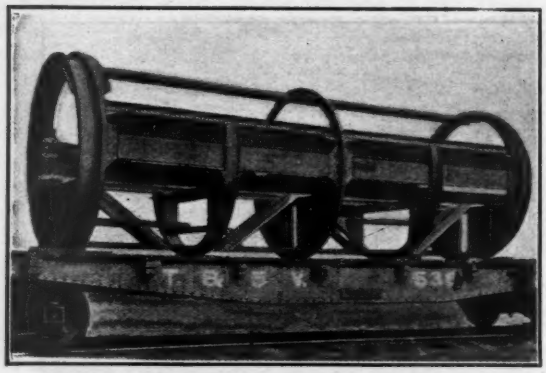
Where a supply of compressed air for general service is not installed only a small compressor



LOAD DUMP.

is required, with an air receiver of sufficient capacity for a single dump.

The illustrations are self-explanatory. The large half-tone shows a three car dump upon an incline delivering to a traveling conveyor which



DUMPING CARS FOR THREE CARS.

discharges into standard railroad cars for transportation. It is built by Wood Equipment Company, McCormick Building, Chicago.

VACUUM DRYING FOR FOOD PRESERVATION

The practice of drying food for the purposes of preservation or long distance transportation is probably older than written history. It has also been of great importance in modern times and dried meats, fish, fruits and vegetables have figured largely both in our export lists and in our domestic markets. The World War created a large and imperative demand for products so treated and gave practical impetus to the study of the processes employed and to their much needed improvement.

Dried foods, while they have been of great economic value, have always been unsatisfactory from the fact of their unpalatableness, and have generally been accepted rather as a necessity. The dehydrating processes also have too frequently failed to preserve the goods except for short periods of time.

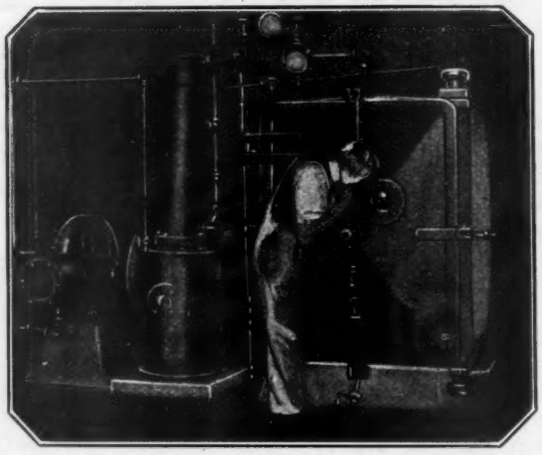
A remarkable process by which food may be preserved for unlimited periods and completely retain its original flavor and palatableness has been originated and developed at the Harriman laboratory, an institution founded by Mrs. E. H. Harriman in memory of her husband. For the account which we are here enabled to present, with also the accompanying illustrations, we are indebted chiefly to *Popular Science Monthly*.

The Harriman Laboratory here spoken of is located on the grounds of Roosevelt Hospital in New York City. It was taken over by the Government when the United States entered the World War. It devotes itself largely to discovering and rectifying the errors commonly made in food manipulation. The first instruction it received was from Lieut. Col. J. R. Murlin, of the Division of Nutrition and Food of the Medical Department, U. S. Army. He wished to know what could be done to prevent meat from spoiling without injuring its nutritive value.

The thing that causes meat to become unfit for use, unless it is cured or refrigerated, is the breaking down of its chief constituent, protein, which belongs to the same family as the white of egg. The jerked beef of the Western plains —dried for days and sometimes weeks in the sun —is so tasteless that the Indians and the Mexicans depend on red peppers to make their palates register food. The dried beef of the grocery store is treated with salt to keep it and with saltpeter to retain color. The new method does away with expensive and long-drawn-out preserving and smoking processes.

LOW TEMPERATURE VACUUM DRYING

Its basic idea is the drying of the meat in a vacuum oven at so low a temperature that, after



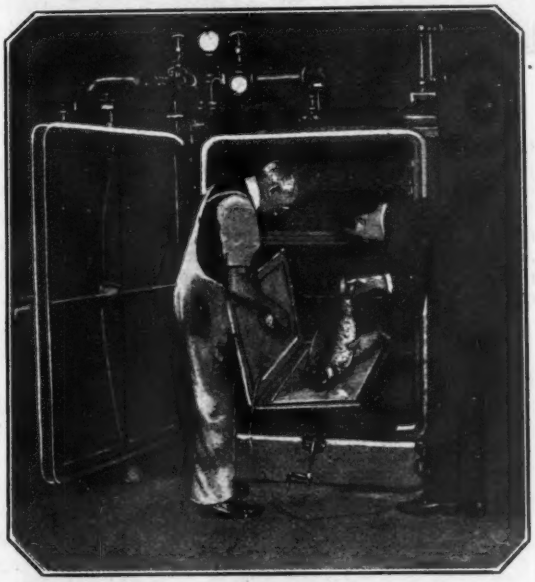
EXTERIOR VIEW OF VACUUM DRYING APPARATUS.

the water has been driven off, the protein and also the delicate ferments and aromas are not injured by the heat. For certain obvious reasons, the exact temperature used and other matters of the sort are for the present withheld; but the proof of the theory is in the eating, and that is found to be perfectly satisfactory.

If meat is to be treated it is first cut into inch cubes or in thin steaks, and laid on trays of wire netting. The trays are placed in an oven six feet square, which looks not unlike a bank safe. This oven is showed closed in Fig. 1 and open in Fig. 2. In the latter illustration will be noticed the bracing of the door to resist the atmospheric

pressure when closed and under vacuum.

It will be understood that more than merly the maintenance of a vacuum is required for the dehydration process. The interior of the oven is kept at the desired temperature—somewhat warm but scarcely to be called hot—by the circulating of water through cells of piping within. The vacuum is only partial and a constant circulation of attenuated air must be maintained for carrying off the moisture. The vacuum is maintained and the low pressure air is circulated by an air pump, which might more properly be called a reversed air compressor, seen in the back-



INTERIOR VIEW OF CHAMBER FOR VACUUM DRYING OF FOOD.

ground at the extreme left in Fig. 1. The air as it is successively saturated with moisture from the food being dried passes out of the oven, down through the condenser and water separator at the side, then through the compressor and into the oven again, the circulation being continuous, but not necessarily rapid, as long as the drying process continues.

The duration of the process depends upon the size of the pieces. About ten hours are needed for such meats as beef and mutton; and from four to eight hours for fish.

H. A. Dixon, division engineer of the Canadian National Railways, with headquarters at Vancouver, B. C., has been made chief engineer of the western lines of the system, succeeding A. T. Fraser, who died recently. He will make his headquarters at Edmonton, Alta.

GIANT AIRSHIPS COMING

The rapidity of development of the airship seems to have fully kept pace with its speed in flight. Its dimensional growth is perhaps most marvelous of all. In 1910 the average endurance of the German rigid airship at a cruising speed was under one day, and the maximum speed about 50 miles an hour. In 1918, with the German L70 class of 2,195,000 cu. ft. capacity, the endurance at 45 miles an hour rose to 177.5 hours, and the speed to 77 miles per hour. The British R38 class, a contemporary of the German L70, has a capacity of 2,720,000 cu. ft., and an estimated cruising endurance, at 45 miles per hour, of 211 hours. In a note on the possibilities of the commercial airship, issued recently by the British Air Ministry, it is predicted that future airships will have a capacity of 10,000,000 cu. ft., a propelling apparatus of 6000 hp., and a maximum speed of 85 miles per hour. These ships would be 1000 ft. in length, 150 ft. in overall height, possess a range of 20,000 miles, and could stay aloft for three weeks without requiring refilling. The crew would consist of three officers and 26 men, and the freight capacity would be 200 tons. The cost of a 10,000,000 cu. ft. airship is estimated at between $1,000,000 and $1,500,000.

J. P. Chalmers, assistant secretary of the Empire Gas & Fuel Company, Bartlesville, Okla., has resigned to associate himself with A. J. Diescher, formerly vice-president, who recently started a new oil company at Winfield, Kansas. His old associates expressed their regrets at his leaving, wishing him good luck and presented to him as tokens of their esteem, a gold watch, gold fountain pen and handsome traveling bag.

CHEAP COMPRESSOR RIG FOR TIE TAMPERS

The San Francisco Oakland Terminal Railways, using two Ingersoll-Rand tie tampers for their track work, these tampers being estimated to require 32 cu. ft. of air per min., avoided the purchase of a regular compressor by mounting on a truck a battery of six 11 cu. ft. capacity, electric driven car brake pumps. Double capacity was installed because the old pumps could not be relied on for continuous service. The arrangement was a complete success. The tampers proved particularly successful in tamping heavy special work. On this railway the machines have allowed six men to do the work which formerly required sixteen. Of the six men one is stationed

to flag vehicles while another handles the connection to the trolley wire, leaving the remaining four to do the tamping. With labor at $2.50 a day the relative costs are: Air tamping, $15; hand tamping, $40; a saving of $25 a day. The tampers paid for themselves in ten days. These tampers are also used for flat tamping of ballast in advance of concreting. They are fitted with chisels when wanted for clipping concrete and cutters when used in stripping asphalt.

"OILINESS" OF LUBRICANTS

Before the Physical Society of London, Principal S. Skinner contributed some notes on lubrication. Experiments on the pressure of air in the neighborhood of a flywheel running in contact with a flat tangential board were described, to exhibit the properties of a compressible lubricant. A comparison of the compressibilities and viscosities of the vegetable and mineral oils led to the conclusion that the special quality of "oiliness" was the physical property of incompressibility.

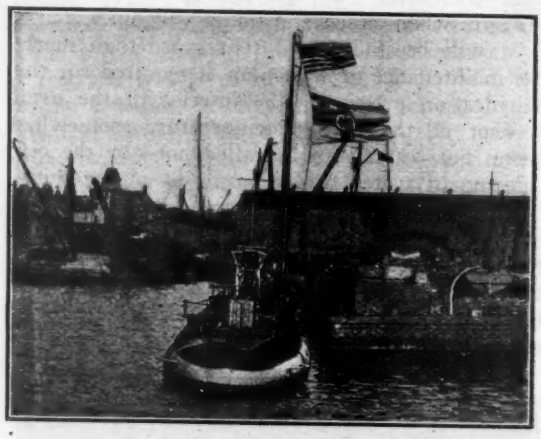
Worthington's experiments on the adhesion of two solids immersed in a stretched liquid were explained as an illustration of the phenomena of lubrication in a stretched liquid. The effect of glass beads, etc., in promoting the free boiling of air-free water was explained by the occurrence of caviation behind the moving beads, etc., the steam entering the cavities thus produced and dilating them into large bubbles.

In the course of a subsequent discussion it was said that some experiments had revealed the curious fact that when working under severe conditions with imperfect lubrication, there was, for the mineral oils, a critical temperature of about 50° C. or 60° C. at which the lubrication broke down. No such temperature had yet been found with non-mineral oils.

THE SONG OF THE AIR

By *FRED GILMAN JOPP*

This is the Song of the Air—
The lifting, drifting air,
The eddying, steadying air,
The wine of its limitless space—
May it nerve us at last to dare
Even death with undaunted face.
Hey, ho! for the Air!



German U-Boat at Navy Pier

Three of the submarines surrendered by Germany became a portion of the allotment of the Kaiser's fleet now owned by the United States and have been brought to New York. The U-111, flying the U. S. Naval Ensign with the German Naval Ensign beneath, is here shown at Brooklyn Navy Yard. An American crew under Lieut. Com. Daubin brought the craft, which was disabled, safely to these shores on a subsistence for three days of pickles and jelly.

(Copyright Keystone View Co.)

Air Ships For Commercial Usage

Since the end of the war there have been startling developments in the navigation of the air and many well-kept secrets are coming to light. During the war there was hidden away in the huge buildings of the White City, London, a great factory, where over 2,000 airships, some of them more than 300 feet long, were built for navy and convoy work. Many of these "blimps" will be used for commercial purposes in the near future. In the manufacture of these dirigibles thousands of men and women were employed. The illustration above shows how the outer fabric after being cemented and sewed together is finally "doped" with a kind of varnish which dries to form a thin flexible covering, making the bag gas-tight and water-proof. The dopers, who apply the varnish with a compressed air paint brush, are protected by masks.

The Aerial Spanning of the Atlantic

By HAVELOCK C. HISLOP

AS THIS issue of COMPRESSED AIR MAGAZINE goes to press Lieut. Commander Albert C. Read and crew have won the honor of having made without interruption the most remarkable and daring journey, daring despite all its safeguards, ever attempted in an airship of any kind. The feat of the United States Navy in flying across a waste of 1,200 miles of stormy spring waters, the actual spanning of the Atlantic, will go down in history as one of the most notable achievements of man.

The world is hailing the plucky crew of aerial navigators that is about to undertake in the famous seaplane NC-4 the continuance of their trip to Portugal and England while deploring the probable fate of the courageous Australian aviator, Harry G. Hawker, pilot of the missing Sopwith transocean flyer and his navigator, Lieut. Commander Mackenzie Grieve, R. N., who with consummate daring had set off from Newfoundland for Ireland or England in a comparatively small plane from which the landing undercarriage had been dropped.

It would be premature to attempt a description in anything like authentic fashion of the aerial voyages of the three American seaplanes to the Azores. All the facts will not be in, so that the undertaking may be analyzed carefully, for weeks to come. One American plane, handicapped by a sudden blanket of fog off the Azores, was obliged to descend into a fairly rough sea, losing her wing pontoons. Her crew was rescued. Another plane came to rest on the water near her goal because of the same weather conditions, and this, the flagplane NC-1, under Commander Towers, like its sister craft in tribulation, the NC-3, was considerably damaged.

Every detail of the transatlantic flight, including the exact position of sixty-five battleships, destroyers and supply vessels, was worked out and embodied in an official order issued April 15. This was made known when "Operation Order No. 1," a document of some 5,000 words was made public after word arrived of the start of the longest leg of the flight.

Although issued a month before, not a single change was found necessary in the detailed instructions. In view of the extreme uncertainty surrounding long distance airplane flights—an uncertainty to which the British fliers who were at Newfoundland for weeks would testify—this was regarded as remarkable. In the order, which was signed by Capt. Harris Laning, Chief of Staff of the Destroyer Force, appears the following sentence:

"The start will be made early in May to get benefit of full moon on May 14 for long leg Newfoundland to Azores."

The departure from Trepassey was predicted as about one hour before sunset. The route was described as follows:

"Mercator's course from Mistaken Point to Coro (smallest and northernmost of the Azores) as a landfall, thence shortest route to Horta or Punta Delgada, the first port of landing being dependent on weather on arrival at Corvo or on some emergency arising on planes that requires landing before reaching Punta Delgada. If weather and other circumstances are favorable, landing will be at Punta Delgada, otherwise planes land at Horta, wait for good weather or completion of repairs, then proceed to Punta Delgada."

The pioneer flight of the NC seaplanes to the Azores was an achievement that put the United States Navy in the lead in aeronautics. It was well planned, courageously and skillfully carried out. Previously no land or sea plane had made a non-stop, straightaway flight of 1,000 miles. The longest continuous flight is said to have been that of Captain G. Lauriati, who traveled from Turin to Naples and return on Aug. 29, 1917, a distance of 920 miles. But it is obvious that his performance, excellent as it was, is not to be compared, for risk and audacity, for physical endurance and fortitude, with the venture of the American naval men that took them through untried atmospheric conditions and the obscurity of night hours above the surges of the perilous Atlantic to the sentinel Azores.

In its success the enterprise of the stout-hearted Americans makes a moving appeal to the imagination. Well may the Stars and Stripes be waved with elation! The American people, whose faith in their navy never falters, for never has it failed them, are proud in knowing that the service has proved to be as daring and efficient in the air as it always is on the sea, whatever the emergency. There was a thrill in the brave flight to the Azores that compensated for the rigors of the stern chase to place American aviation in the van, where it always should have been.

To regard the flight to the Azores as a feat of sportsmanship would be to misapprehend the motive and purpose of the Navy Department. The flight, planned to continue to Portugal

and England, was a test of seaplane designs of the naval constructors associated with Glenn H. Curtiss, and a trial of the training, skill, and stamina of our best naval aviators, Commander Towers, Lieut. Commander Bellinger and Lieut. Commander Read and their crews. Secretary Daniels declared that the Atlantic flight had been planned for two years, but the word to stand by and get away could not be given until every detail had been carefully worked out. The navy is thorough; it does not trust to luck.

The orders were to make the trip "in the safest and sanest way." Rivalry with other services, or with any aviators flying for glory and reward, was not considered. While Commander Towers and his flotilla have done a big thing, its usefulness and the prestige of it alone concern the service and the department.

The transatlantic flight of the three NC naval seaplanes was made safer by devices employed for the first time in this enterprise. Among these were especially designed navigation instruments which enable pilots to keep their course when out of sight of land.

Three of these instruments were an aerial sextant, a drift and speed indicator and a course and distance indicator, according to a Navy Department statement which has come to our attention.

"No airplane," the statement explains, "has ever flown far enough out to sea to warrant the use of the sun, moon and stars for fixing a geographical position, as is done on seagoing ships. Navigation, therefore, on a transatlantic flight is new and untried, and it has been necessary in preparing for this flight to design three new instruments for navigational use."

A unique feature of the aerial sextant, known as the Byrd sextant, the statement continues, "is that a bubble in a tube takes the place of the sea horizon and observation. A specially constructed lens is used in sighting the bubble, which is reflected in a mirror. The sun is reflected in another mirror. The observer brings the sun tangent to a line at the same time he brings the bubble tangent to the line. That gives the altitude of the sun.

This is of especial value, as the aviator is often above the clouds, and even when flying at low altitudes the horizon is too dim to be seen clearly. With this new aerial sextant the curvature of the earth does not have to be taken into consideration in calculating position. The bubble is lighted at night, so that night observations may be taken.

"New methods of astronomical calculations also have been devised which enable the navigator to make his calculations in a fifth of the time formerly necessary. A zenithal projection chart of the Atlantic Ocean has been especially constructed for this purpose. This chart, a new invention, does away with difficult mathematical calculations, enabling the aviator to determine his position in a few minutes.

"Another great problem of the seaair navigator is the calculation of the speed and direction of the wind, both day and night. In spite of the reliability of the compass it can only give the course upon which the craft heads, and in determining the true course proper allowance must be made for the sidewise drift caused by the wind. For example, a wind blowing thirty miles an hour toward the side of the plane will allow it thirty miles an hour out of its course. This fact alone makes the navigation of the air far more difficult than the navigation of the sea.

"To overcome this difficulty bombs have been invented which ignite upon striking the surface of the water and give a dense smoke and bright light for ten minutes.

"An instrument is used in conjunction with this bomb which enables the the navigator to determine the velocity and direction of the wind by sighting on the smoke in the day time and the lights at night. This instrument, called the speed-drift indicator, has proved successful.

"When the navigator has found the speed and direction of the wind, he must then be able to calculate the course to steer toward the Azores to allow for this wind. To do this an instrument has been designed to solve the triangle of forces, thus doing away with cumbersome mathematical calculations.

"The navigator's cockpit is in the forepart of the boat and is equipped with a chart board, a chart rack and lights. He also has a specially designed headgear for telephonic communication with the pilots so that he can direct them when to change course. The noise from the four big motors is so great that it is impossible to hold conversation except with specially designed telephonic apparatus.

"The navigator also has instruments which show him the altitude of the plane and the time the sun keeps with the Greenwich meridian, because in going to the eastward so rapidly it is difficult to keep the correct time. In going from Newfoundland to the Azores over two hours is lost in a period of twenty hours, so that the navigator must be very expert in order to allow for this loss in time in making his astronomical calculations.

"In aerial navigation positions must be determined very quickly. The navigator sits down to work out his 'sights' to fix his position and

will be far from his calculated position unless he works out his calculations very rapidly, which these instruments enable him to do."

From the Navy Department has been procured the following official tabultaion of the time details of the flights of the three seaplanes from Newfoundland to the Azores and vicinity. The corrected official starting time for the planes was:

NC-1—5:36 New York time, [21:36 Greenwich time.]

NC-3—6:03 New York time, [22:03 Greenwich time.]

NC-4—6:07 New York time, [22:07 Greenwich time.]

As expressed in New York time the record of the flight so far as received was as follows:

	NC-1	NC-3	NC-4
Took off, Trepassey	5:36 p. m.	6:03 p. m.	6:07 p. m.
Out of sight.....	6:30 p. m.	6:20 p. m.	6:20 p. m.
Passed No. 1	.....	.....	.....
Passed No. 2	7:35 p. m.	7:35 p. m.	7:35 p. m.
Passed No. 3	8:03 p. m.	.....	.....
Passed No. 4	.....	.....	.....
Passed No. 5	.....	.....	.....
Passed No. 6	10:05 p. m.	10:05 p. m.	10:05 p. m.
Passed No. 7	.....	10:58 p. m.	.....
Passed No. 8	.....	.....	11:29 p. m.
Passed No. 9	.....	12:10 a. m.	.....
Passed No. 10	.....	.....	.....
Passed No. 11	.....	.....	1:50 a. m.
Passed No. 12	.....	.....	.....
Passed No. 13	3:13 a. m.	2:23 a. m.	.....
Passed No. 14	.....	.....	3:06 a. m.
Passed No. 15	.....	.....	.....
Passed No. 16	5:17 a. m.	.....	4:30 a. m.
Passed No. 17	.....	5:15 a. m.	.....
Passed No. 18	6:14 a. m.	.....	5:45 a. m.
Passed No. 19	.....	.....	.....
Passed No. 20	8:10 a. m.	.....	.....
Sighted land	.....	.....	7:35 a. m.
Passed No. 21	.....	.....	.....
Passed No. 22	.....	.....	8:10 a. m.
Arrived Horta	.....	.....	9:25 a. m.

I note in *The New York Times* an interesting and timely comment on the rivalry of the American and British aviators in Newfoundland and how it recalled a morning at Calais some ten years ago, in July, 1909, when Louis Bleriot astounded the world by flying across the English Channel in a frail monoplane that cost only $2,000 to build.

Bleriot, it will be remembered, had a rival in Herbert Latham, who had fallen into the sea six days earlier when as many miles from Calais, but who was game to make another start. Latham must have been a calm, philosophical person, for he was sleeping comfortably on the morning of July 25, although he knew of the presence of his rival, when Bleriot, after a feverish trial trip, rose again and launched his little monoplane out over the surface of the sea. Some one aroused Latham, and to his chagrin he saw Bleriot making off in the first gray light to win the laurel wreath which he was to wear if his engine did not stop cold again.

It was a Sunday morning, and forty minutes later early risers in Dover saw the bold Frenchman flutter down from the air after his plane was spun around twice in tricky winds. It is to be noted, because the circumstance emphasizes the skill, daring and luck of Bleriot, that Latham tried the Channel passage again and once more fell into the sea, this time near enough to Dover to give him a panoramic view of the white cliffs, the town and the surf beating at its foot.

From flying the strip of water called the English Channel to flying to the Azores illustrates the wonderful progress made in aviation in less than ten years. In 1909 it was regarded by the undiscerning as a sport with a dubious future.

Only the emergency of war roused the apathetic official mind, and then Britannia came to her senses; at the time of the armistice she had 22,000 airplanes, according to a report by the Air Minister. It was, indeed, the war that spurred inventiveness, that stimulated skill and intrepidity, until the airplane attained a measure and scope of achievement undreamed of in the experimental days when Bleriot flitted across the Channel in his flimsy monoplane.

Man after more than four hundred years of scheming and experimenting, as *The Times* notes, has learned to fly better than the eagle and the condor. All the books on the subject give Leonardo da Vinci, who was an engineer as well as a painter and sculptor, the credit of designing the first pair of wings by which biped man was to share the air with the birds; there is a print of the design dated 1500, and the books are full of queer contrivances that now excite laughter. But when the present century had dawned there were men still planning to fly by their own muscular power.

Not until the invention of the gas motor was there any hope that the planes inventors were toying with something that could be converted into a machine available for useful flight. And the gas motor had to be vastly improved before long flight was possible. The land plane suggested the seaplane, but the development of the latter, which requires a very powerful engine to lift it from the water, was slower.

A year ago W. H. Berry, in his "Aircraft in War and Commerce," made this prediction: "When the Atlantic is at last flown, an any-day possibility, it will be by a machine of this type," (the seaplane).

When the leader of our seaplane squadron neared Flores, expectant watchers must have seen

one of the most astounding occurrences of any place or time. A man-driven contrivance had crossed on the wing the waters that until a few centuries ago stopped humanity. The sight was one that would have stirred any comprehending human being from the philosopher to the bushman. It was a sight to have made any of our predecessors on the earth marvel. A growing speck in a hitherto empty western sky!

As we write the first flight across the Atlantic Ocean remains to be completed. From the easternmost of the Azores to the nearest point of the European mainland stretch nearly 800 miles of sea. This has yet to be crossed, The great venture has not yet triumphed. The fliers have at least won the hardest part of the battle. The long overseas flight of some 1,200 sea miles, performed by all three without a hitch, except at the finish, exceeds all the flights over water hitherto accomplished, and its success gives promise of the full completion of the crossing.

This new victory over space as we have seen, was won by methodic preparation far more than by daring. The plans, based on close calculations, left only a minimum to chance. In so far as daring consists in taking chances these bold navigators of the air might paradoxically be called the least daring of men, for they did everything possible, or it was done in their behalf, to eliminate chances, instead of taking them. But there is a more far-reaching sort of daring, that which ventures into the new and untried, relying on the preparations that laborious prevision can furnish. To this spirit of enterprise we shall owe the capably planned airplane crossing of the Atlantic, even as we owe the reasoned and foreseeing boldness of Columbus and the imaginative practicality of Cyrus W. Field. One of these two first crossed the surface; the second spanned the bottom with his cable. Our fliers will complete the task by their transit through the air.

When the news first came that the Australian, Hawker, and the Englishman, Grieve, had soared into the air at St. John's in their frail biplane and sped away on their perilous attempt to fly the Atlantic, without patrolling ships to guide and aid them, without even a pontoon to float them if they were forced down to the sea's surface, the heart of every red-blooded man leaped in his breast.

That picture of the daring shipmates dropping the undercarriage which was used in making the start and would have served to make a landing in Ireland safe, and sweeping out to sea above the Newfoundland cliffs, resolved to do or die on the sea and take the risk of disaster if they ever reached Ireland, will live in the memory. The risk was desperate, but the spirit was the spirit that is stronger than fears of the flesh and triumphs over it, so that full success becomes of minor importance when the record is made up.

According to early but unconfirmed reports they appeared to have come nearer to accomplishing a "transatlantic flight" (the term is somewhat ambiguous) than any one else, and to have established a distance record for non-stop flying.

Somebody who has been figuring up what the voyage of the NC boats has cost, or will cost, before it is over, has arrived at the total of a round million. That is too much, and probably far too much, for to reach it there must be included the pay of all the officers and men on the many warships, big and little, that were used in the task, as well as what was spent for their fuel and general maintenance while the experiment is in progress. The salaries of these men, however, would have to be paid anyway, and there was no increment in the bills for their food.

It is true, indeed, that the expenses of ships at sea are greater than when they are in harbor, but the difference is far from being that between nothing and the cost of active cruising.

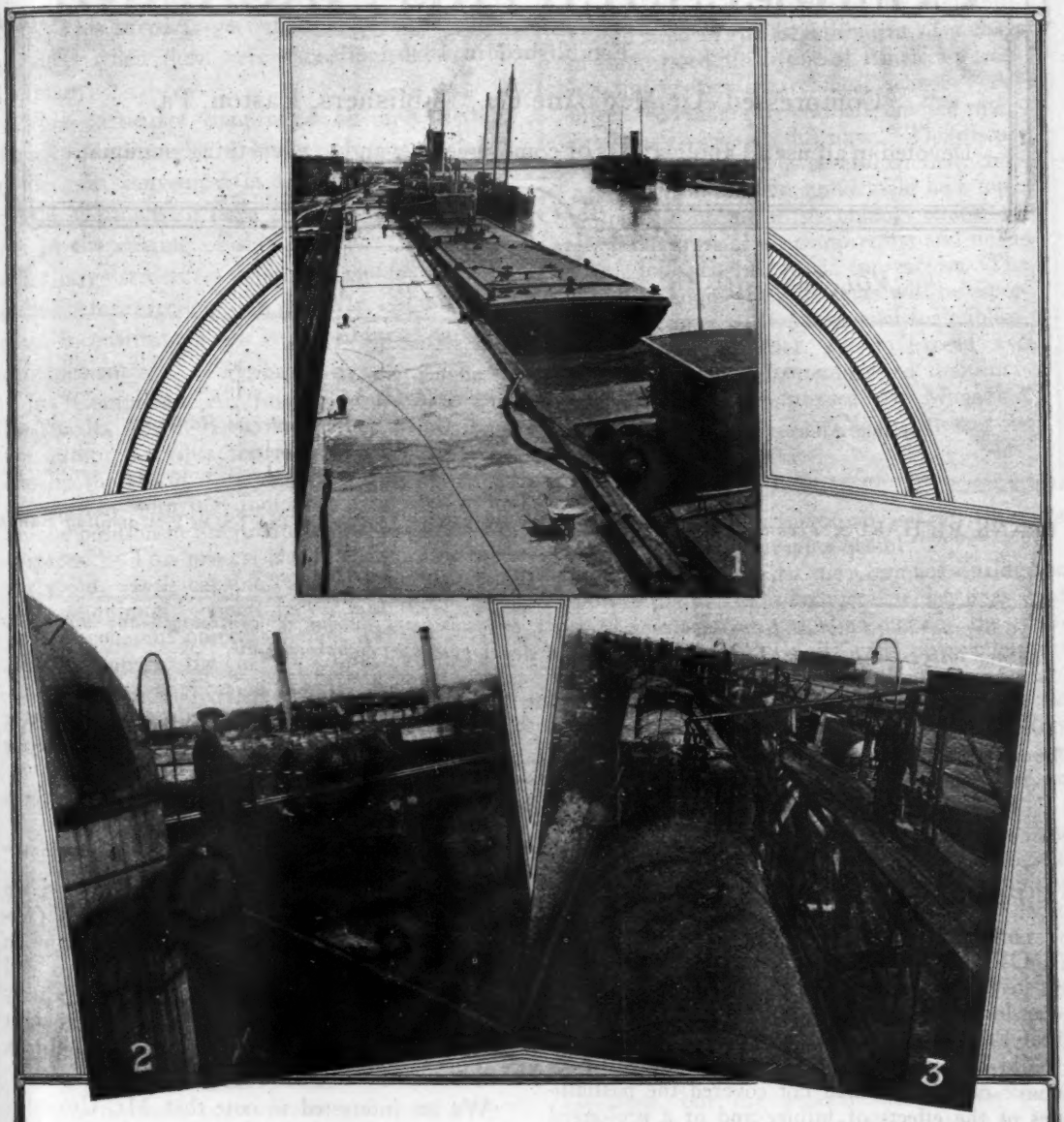
With all allowances made, the cost of the great experiment was considerable, of course. Still, it was not money wasted, nor must it all be charged up to the testing of the capacity for long ocean flights of three hydro-aeroplanes. Naval preparedness requires frequent evolutions on a large scale in time of peace, and this was an evolution or practice cruise of a highly significant and instructive kind. It involved a lot of elaborate planning to establish that long line of vessels and to keep them in it, and the success with which it was done is highly creditable.

Its results ought to be reassuring, too, as to the efficiency of our navy—if anybody needs reassurance on that point—for the plan worked out perfectly. The ships did what and all that was expected of them, that is, and the misadventures of two of the planes cannot be ascribed to anybody on the surface-going craft.

The whole undertaking, viewing it as we have endeavored to do, in its various aspects, only brings us to the conclusion that transatlantic flying as a regular matter, of course, is not so remote as most folk have imagined. Within a few years, it is confidently anticipated by aviation and dirigible ballooning experts, we shall be flying to many places that are now commonly reached by steamship and railway.

When the writer flew to the height of a mile with Roland Garros over Rio de Janeiro harbor eight years ago, he thought it a limit in aerial daring! Aviation has not yet hit its gait.

The Great Oil Industry of the Southwest



(Photos copyrighted, Underwood & Underwood.)

1.—OIL HARBOR AT PORT ARTHUR, TEX., SHOWING SEVERAL BIG TANKERS.
2.—FILLING A WHOLE TRAIN OF TANK CARS AT AN OIL LOADING RACK NEAR CUSHING, OKLA., FROM PROPERTY OF THE SINCLAIR OIL & GAS CO.
3.—STILLS (AT THE RIGHT) AND CONDENSING PLANT OF THE COSDEN OIL CO.'S REFINERY AT WEST TULSA, WHERE GASOLINE IS PRODUCED.

The great oil industry of the United States, in which compressed air has long since played such a leading part, is being subjected to an increasing demand for fuel oil for oil-burning ships. The Sinclair Company, from whose property oil is being loaded in the picture above, has lately completed a pipe line 800 miles long connecting the Oklahoma and Kansas fields with Chicago, relieving the railroads of hauling 20,000 barrels a day.

COMPRESSED AIR MAGAZINE

Established in 1896

Compressed Air Magazine Co., Publishers, Easton, Pa.

Devoted to all useful applications of compressed air and to everything pneumatic

VOL. XXIV, NO. VI. *JUNE, 1919.*

Editorial and Business Offices:
NEW YORK: Bowling Green Building, No. 11, Broadway
Telephone: Bowling Green, 8430
Cable Address: "Compaire" N. Y., Western Union Code, Universal Edition
LONDON OFFICE: No. 165, Queen Victoria Street

W. L. SAUNDERS, *Editor*
FRANK RICHARDS, *Technical Editor* FRANCIS JUDSON TIETSORT, *Managing Editor*

CHARLES A. HIRSCHBERG, *Business Manager*

Correspondence invited from engineers, chemists, experimenters, inventors, contractors and all others who are interested in the applications, practice and development of compressed air.

Subscription rates—Postage included
The United States, American possessions and Mexico.....$1.00 the year
Dominion of Canada and other foreign countries..... 1.50 the year
Single copies—Ten cents

NOTE—Subscribers will please notify the Circulation Department at once of change of address or in case of belated delivery or non-delivery.

PLATING BY COMPRESSED AIR SAVES GERMAN METALS

FOR GERMANY it was a war of struggling invention and makeshift in substitutes. The war lords had figured originally that they could beat France to her knees so quickly that conquest would be complete within a few months. Economic calculations had not covered the possibilities of the effects of failure and of a prolonged war on the German population. Many industrial plants were turned over to munitions making. As the war went on, raw materials became harder and increasingly harder to obtain. The chemists were called in consultation to substitute for almost all the necessaries the German population consumes in normal times.

There were scores of food substitutes, none of which are ever likely to achieve commercial importance, for the Teutons themselves are declared to be sick of the very sight of them! One well-informed correspondent, Samuel Crowther, of *The New York Tribune,* lately returned from Germany, declares however, that it is likely German coffee, for many years to come, will contain but little coffee and that German tobacco will consist largely of cherry leaves. It is significantly observed at the same time, incidentally, that what goes into coffee and tobacco in most countries will always be a lay mystery.

We are interested to note that Mr. Crowther observed a method of plating metals, in which compressed air was employed. This machine for plating, the correspondent declares, is very highly regarded by the Germans. The surface to be plated is cleaned with chemicals and then a thin sheet of the plating metal is blown on with a device resembling a hand torch. The torch contains a small electric furnace which reduces the plating metal to a liquid and through the connection with a tank of compressed air the molten metal is sprayed onto the surface.

By this method, gun metal, brass and copper

were put on iron or steel for such parts of machines as required it, the coated metal parts being used instead of solid gun metal, brass and copper. This saved large quantities of these three products when they were exceedingly scarce in Germany.

This particular compressed air and electric furnace plating scheme is portable and declared to be most convenient in usage. It is expected by the Germans to have a permanent and wide use in the coating of ship's bottoms, tanks and other large structures where the plates cannot be plated before erection. In fact, Mr. Crowther reports, it constitutes a new variety of metal painting arrangement.

In "Compressed Air for the Metal Worker," by Charles Austin Hirschberg, New York, 1917, the author describes the recently perfected process by the German, Schoop, for applying metal coatings by spraying, indicated as occupying "a unique position in the production of non-corrosive surfaces." This process is said to be about eight years old. It is capable of depositing lead, tin, zinc, aluminum, copper, nickel and their alloys on any coherent object, whether metallic or not. The thickness of the coating is under instant control and the application can be limited to any portion of the object.

The difference between the original Schoop method and that described by Mr. Crowther is that the former involved the use of a "pistol," air at 40 lbs. pressure, a tank of hydrogen and another tank containing some reducing gas, usually oxygen, acetylene or blau-gas, the metal to be applied being liquified in flame, whereas in the latter a small electric furnace is utilized to make the metal molten before it is projected by the air pressure.

The Schoop process has been used in the United States to some extent, but is still susceptible of considerable development. Here its use is said to have been wholly for its convenience in ordinary practice and not as an ecomonical expedient such as prompted its employment in Germany during the war.

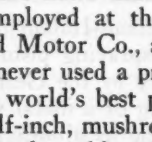
We have seen its work as applied to the coating of clay models with bronze. Here is a chance for the Italian vendors of plaster of paris "statuary" to give greater verisimilitude to their deadly work in copying bronze groups. Let us have, too, a restored Venus de Milo done in bronze veneer with both arms and do away once and for all with the icy purity of the marble replicas that wont sell because one arm is broken! On the heels of the Fiume diplomatic fiasco will there come a German-Italian *entente cordiale* through the metal-spraying pistol?

Another discovery by the Germans during the war was the making of a metal which is as light and almost as strong as aluminum by the treatment of "electron" (which was discovered just before the war) with chlorate of magnesium. This new metal was used to a considerable extent in the construction of airplanes and Zeppelins after the supply of aluminum gave out. At present this new metal is expensive, but expectations are that it will be developed.

These are indications of how chemistry and industry have coöperated in Germany during the years of war and betoken post-war possibilities. Officers of the large works at Ludwigshafen, Leverkusen and Hochst, so Mr. Crowther reports, were not so confident of the future of their industry as are most commercial Germans. The first-mentioned two works are in the territory occupied by the French and English respectively and that may have affected the viewpoint of the Germans, but the general idea of the works managers seemed to be that the progress of English and American dye manufacture, with the probability of high protective tariffs, would deprive Germany of one of her most valuable lines of export trade. It was regarded as likely that it might be found necessary to run their plants largely in the direction of finding substances which would reduce German imports. The German dye industry cannot exist without England and the United States, for at best the German textile mills can consume only a fraction of the pre-war output.

IN THE JULY issue of COMPRESSED AIR MAGAZINE there will be published a symposium on the subject of the advisability and need of the establishment of a chair of compressed air at one of America's leading universities or technical schools. All interested readers are cordially invited to express their views on this topic. The discussion will be opened by several eminent compressed air authorities and should be a topic of liveliest interest for technology educators, manufacturers of air compressors and pneumatic tools, engineers and contractors. The views of engineering students will be especially welcome. Ideas expressed for publication should be brief, not to exceed 250 words, and should be addressed to Educational Editor, Compressed Air Magazine, No. 11 Broadway, New York, before June 10.

Many of the German industrial plants are in readiness to start up again on 24 hours' notice and with their former staffs are waiting for work, which is dependent on the arrival of raw materials. The owners know they will have to pay high wages, but are declared not to be afraid of this, as they think wages in America and in England have gone higher than the German scale and that the old ratios will continue. They believe all prices everywhere will simply be marked up. In this the isolated Germans are held to have been entirely correct except as to the tense they employed. Prices have reached their apogee and are now on the descendant in most countries.



A NEW RIVETING RECORD AT FORD EAGLE PLANT

FROM the River Rouge (Mich.) Ford Eagle plant comes the news that one Vasco Miliken, formerly employed at the Highland Park plant of the Ford Motor Co., and who up to six months ago had never used a pneumatic hammer, has exceeded the world's best previous record by driving 5,542 half-inch, mushroom-head rivets in eight hours of actual working time. So much depends upon the conditions under which a riveting "record" is made, that the editors of this publication took the trouble to ascertain directly, from responsible officials of the Ford company, the facts in connection with this performance, which, to say the least, is an unusual feat.

Miliken's riveting crew consisted of himself as riveter, two buckers-up, two rivet heaters and four rivet passers, nine men in all. In addition to the eight-hour stretch of actual riveting, time was taken out for the repair of two forges and the replacement of a broken hose connection to the air hammer. According to Mr. R. J. Whiting of the Ford company, only one hammer (a Boyer No. 50 type made by the Keller Pneumatic Tool Co.) was used to drive the entire number of rivets. Air pressure at the hammer was 80 pounds. The rivet head had a crown of about three-sixteenths of an inch, which gives its kind the name of "mushroom."

All of the rivets were driven on the side shell of a boat under construction at River Rouge, and only two rivets were rejected by the government inspectors. Miliken is described as a man of medium build, being five feet, nine inches, in height and weighing 170 pounds, and is reported to have withstood with no ill effects the strain of his essay into the field of record-making. His average speed during the eight-hour journey was to drive a rivet every five seconds and a small fraction over, or allowing him six seconds to every twenty-eighth rivet.

The former riveting mark, in this country, at least, is recorded, we believe, as having been 4,700 of seven-eighths of an inch diameter, in eight hours.

Other notable riveting records, figures for which we chance to have at hand, are those of R. Farrant, who drove 4,276 half-inch rivets in nine hours on May 7, 1918, with a "Little David" riveting hammer, at the plant of Fraser & Fraser, Bromley-by-Bow, London, England, and that of William Moses, also using a "Little David" that had already been in use for a year, who drove 5,894 rivets in nine hours on May 23, 1918, at the Vickers Naval Construction Works, Barrow-in-Furness, England. The latter record was roughly at the rate of a rivet every five and one-half seconds.

In these columns, in the issue of August, 1918, Mr. Frank Richards in commenting on riveting records, which last summer were quite the fashion both at home and abroad, remarked:

"It was said of the charge of the Light Brigade that it was very brilliant, but it was not war. So without questioning at all the veracity of the current riveting records, we are tempted to say that they may be very brilliant but they are not shipbuilding, if indeed, they can be called riveting."

Riveting records that count, as Mr. Richards truly said, are the collective records per week, or other period, of all the rivets driven by all the riveters employed upon a single ship or upon a single shipyard way. This would tell us a real story of shipbuilding, and would indicate not only the riveting performance but show the co-operation of all hands to produce the desired results.

In practical, everyday shipbuilding, the riveting record does not count for much. Making a record is a "stunt," pure and simple, just as was the "building" and launching of the *Tuckahoe* in twenty-seven days at Camden. A riveting record all depends, in the first place, upon the way the stage is set, upon the preparations made for it, no matter the endurance and gameness of the riveter himself. This does not in the least detract from the credit due Miliken or any other "star" riveetr, in viewing such a feat as a sporting proposition. The fact is, however, that such speeds cannot be maintained in daily practice and that it would be foolhardy to attempt them. They do, however, serve the useful purpose of helping to set a high daily average for riveting.

In the course of the war the big shipbuilding plants encouraged record-making wholly for the

purpose of showing riveting gangs what *could* humanly be done, and this served to elevate the average standard of performance. Records were kept at most of the plants on blackboards set up in some conspicuous place, and as the average Yank workman is a game animal, one gang wouldn't want to see another gang putting it in the shade!

Sawing wood or hoeing beans, either by itself is not such great sport, but if one has a wager up or there is a prize in sight, the enterprise immediately becomes a horse of another color. It is the old story of the boys whitewashing a fence, as witness the immortal Tom Sawyer's gang. They even paid Tom in marbles and other plunder for the *privilege* of whitewashing on the job he ostensibly worked upon with such supreme delectation and artistic touch! Workmen, like all of us, are just boys grown up!

HOW COMMODITY PRICES AFFECT LIBERTY BONDS

INDUSTRIAL workers by the hundreds of thousands "put over" the five Liberty Loans. Many workers have had only a hazy notion about the ins and outs of the market values of these bonds, or have been perplexed in individual cases by the below-par prices quoted when they have found it necessary to sell part of their holdings.

Thomas Gibson, financial authority and economist, discussed recently in the New York *Times* the value of the Liberty Bond as an investment, holding that it will increase as commodity prices fall. Prices generally are now very high, the index numbers showing them to be 100% higher than those of 1913. They are expected to remain fairly high; or materially above normal while the work of imperative reconstruction is proceeding, but Mr. Gibson declares it inevitable that prices of all the things money will buy will be much lower before long.

Quoting Amasa Walker, "value always expresses precisely power *in exchange,* and no other power or fact." This being true, it is obviously the case that the Liberty bonds and Victory notes will increase in value in inverse ratio to falling prices for any or all other things for which they may be exchanged, it is argued.

As an illustration it is offered that the man who owns any of the earlier issues of Government bonds can already demonstrate an increase in value between the date of his purchase and the present time. He can exchange his bonds for twice as much copper or 50% more cotton than he could have exchanged his money for at the time he invested it in bonds.

This is held as obviously true of money in any form, "but money could and can be placed in the Government issues at a higher rate of interest, considering the safety of both principal and interest, than in any other channels, not excepting the saving banks."

Unless all the economists of the first rank are wrong in their prophecies, and unless all precedents are shattered, Mr. Gibson finds, we may confidently look forward to a much lower range of prices for all classes of necessary commodities in the course of the next two or three years.

With prices doubled, roughly, over what they were in 1913, a part of this increase may, and probably will, be returned indefinitely for reasons not connected with war conditions, but the greater part of the advance will be lost.

Owners of sound bonds are certain to see their financial positions improved and their real wealth greatly increased in a comparatively short time.

While the American people for the most part did not have to be reminded of these things to make them buy of the five loan issues, it is a comforting and satisfactory reflection that they bought profitably as well as patriotically. Many people loyally purchased more bonds than they could carry in financial comfort; others found themselves unexpectedly embarrassed and obliged to liquidate their holdings; still others invested funds that were free only temporarily. As a natural result the offerings from these and other sources resulted in price concessions.

This answers the puzzled inquiries of many men and women, uninitiated in finance, as to why the bonds should decrease somewhat in market value. But another and more important cause has been the pressing demand for capital and resultant high interest rates. Security prices are more easily and more frequently affected by interest rates—the rental which can be procured for surplus funds—than by considerations affecting the future value of principal. The unusual demand for capital in war industries has kept interest rates high for years and may keep them higher than normal for a time.

There are evidences of relaxation, however, and with a release of capital, low rates for money will ensue. When the most important reconstruction work is completed, there will likely be a plethora of investment funds. This will mean low interest rates and high bond prices.

The war and the five public loans have done much for the financial consciousness of the American people. The carefully selected advertising matter used in the various Liberty loans, aside

from the appeals to patriotism, have been well calculated to stimulate in us the bond buying habit, or at least saving in some form. In buying on low and favorable terms the greatest of all boons for mankind, we have simultaneously added a cubit to our stature of thrift, which is our financial strength.

NATIONAL HEALTH THROUGH THE PROGRESS OF SCIENCE

MORE and more do we depend upon the scientist to solve our economic, our industrial, our living problems. In war or in peace he is indispensable.

That renowned English scientist, Sir William Crookes, who died in April at eighty-six after his long and highly distinguished career, granted a most interesting interview only about a month before his demise. He made certain assertions that are entitled to world-wide appreciation and recognition.

As an instance, he declared that "the scientist is the real standard bearer and pioneer of industry and progress today." One of the immediate problems of science, in his view, was to effect vital economies by developing to the utmost, at the smallest expenditure of material, our capacities for generating heat, light and motive power.

He held there was no use in attempting social palliatives that were doomed to scientific disaster; that the scientist should be regarded as guide, philosopher and friend to every class in a community; that to be really good, man must be really happy, and to be happy he must be healthy. Therefore, the practical task of scientists today is to secure the nation's health. Sir William stated unequivocally that "the scientist will be the pivotal man of the world's work of tomorrow."

Chemists are doing a great deal for us. They are among the assuredly "pivotal" men in our country at present and are solving great problems that come with war's aftermath. The American Chemical Society, which held its annual convention at Buffalo recently, now has a membership of 12,000. There are few more important men in the world of science than these hard-working good Americans, who deserve our tribute and thanks for their tireless research to make our world a more beautiful, a more habitable, a more comfortable place.

Before the American youth sets off to college, academy, institute or university and the ever-recurrent question arises, "What shall his career be?" there must be clear thinking and the taking of competent advice in considering the highly useful professions, always taking into calculations the young man's own predilections and likings.

Engineers and chemists, good ones, are needed in our national life in increasing numbers. There is a cry now for more metallurgical specialists, who, if they have engineering ability also at their disposal, will never know an idle moment, other personal requisites being equal.

Success in such callings brings with it ample rewards, not only in material compensation, but in the warming satisfaction of having done something worth while for one's fellows.

The sciences and their professional applications point the way to health, wealth and happiness. They make for cleanliness, strength and character in national life. In them, too, lies our national security.

HOW EMPLOYEES OF INDUSTRIAL PLANTS FOUGHT INFLUENZA

THE War Department records are reported to show that the State of Pennsylvania lost more soldiers in the war than any other commonwealth. That mysterious malady called influenza, which made a virulent arrival in America last autumn, carried off more Pennsylvanians, however, than the casualties of battle and military life.

Almost every other State suffered in like ratio from the scourge that came in the trail of war, a pestilential affliction which for a time almost stopped the whirr of industry's wheels, which closed schools and theatres, which caused millions to wear germ masks, which overcrowded hospitals, enriched undertakers and wore the nerves of tired physicians and nurses to the snapping point. It was a trying time for countless thousands of patient folk, whose patriotism and good nature already had been tested severely by war's costs and restrictions.

At Easton, Pa., and across the Delaware river in Phillipsburg, N. J., where are located the large factories of the Ingersoll-Rand Company and of the A. S. Cameron Steam Pump Works, the population was confronted suddenly with a problem that could not be solved with existing hospital facilities. Hundreds of wage earners, heads and members of families in the community, were employees of the Ingersoll-Rand and Cameron plants. When a final summary was made, it was ascertained that 1448 employees had been stricken down with influenza, pneumonia, or both. The records showed that 1,091 of the sev-

eral plants' working forces were absent from duty at one time.

In the emergency that arose, prompt and efficient measures had to be taken. The employees decided to convert the I-R Employees' Club House into an emergency hospital to care for the more serious cases and to make the building a centre for directing general relief measures in the vicinity. The metamorphosis was accomplished in twenty-four hours, thanks to the untiring efforts of a group of devoted men and women volunteers.

The building was equipped, filled to capacity with beds and cots, manned with a personnel and began receiving patients immediately. A kitchen and dispensary, with all other requisite apparatus were installed.

In the face of almost insurmountable difficulties a limited staff of physicians and graduate nurses was installed, but their services were augmented by the services of devoted practical nurses and assistants, and a large volunteer crew of men and women from the company's factory forces. Ambulance and fumigation service was also provided.

The organization and establishment of this hospital under the extraordinary conditions that existed was a remarkable feat in management and an unusual exhibition of resourcefulness. To express its thanks and appreciation the Ingersoll-Rand Company later issued an attractive illustrated brochure commemorating the achievements in the emergency of not only the larger Emergency Hospital, with its staff, volunteers, and friends of the company, but also in recognition of the able services of the Works First Aid Hospital.

The executives and other employees also found time to perform much emergency relief work, such as the supplying of scores of homes with fuel, in instances where members of families were incapacitated. Coal and firewood were provided, the company lending motor trucks for deliveries.

In all 165 employees participated in the relief work and 49 automobiles were employed in visiting the stricken and transporting patients and supplies, besides a fully equipped ambulance. When it is considered that 1,069 homes of employees were visited, it is apparent that this fleet of cars must have been kept busy.

The training and discipline of men and women of the working force of the Ingersoll-Rand Company showed to highest advantage in the crisis they were called upon to face and their labors of mercy and devotion reflected high credit upon themselves.

The influenza menace to employees of industrial plants throughout the country has not yet completely disappeared, and here and there have occurred sporadic outbursts. Caution must still be exercised while science continues studying to combat the disease.

GOING BACCHUS ONE BETTER

WITH the inhibition of those forms of public hospitality in which inbibing of strong drink over mahogany tops played an important part, customs and actions curious to many folk will become no doubt a part of their daily lives.

Much time was whiled away or its passage forgotten about in the temples of Bacchus and Gambrinus. This time will have to be spent somewhere, inasmuch as it is all part of eternity, which will still mysteriously claim its sections of mere time, just as worlds become star dust in illimitable space.

The economist gentlemen who glance coldly and inexorably at the passing show while displaying facts incontrovertible, inform us that the time, money, materials, energy and mayhap morals consumed as important incidentals to looking upon the liquor when it is red, will be diverted mostly to our social and business betterment. Our perspectives will be vastly changed when the rosy lenses provided by the bottoms of emptied glasses have departed into the limbo of forgotten things, we are assured. That there be a deal of truth in the observations of the social and business scientists may be adduced from the testimony of those of hardy wills, who without legal compulsion have changed over from lives in which liquor played a daily part to the calm consciousness of mental processes uninfluenced by the warmth of mounting fumes such as gave Omar Khayam inspirations in his wilderness.

Liquor in excess has made many Americans bad judges of distance. Ever try to drive a car home from the Country Club after having dallied over a few high shots at the nineteenth hole? Miscalculations have led to state laws making motoring under such conditions a penal offense. The economists assure us that a large part of our population is going to make many important decisions for itself in years to come with fewer inaccuracies of judgment and with resultant benefits, no matter the protests of those held in the grips of habit or who deplore compulsion.

Nearly every manufacturing industry in Amer-

ica, it is promised, will feel the effects of national prohibition, once its clutch is thrown in, and there is likely to be a general trend toward stepping on our gas. In other words, the optimists say we are pretty sure to speed up and produce more.

To aid the stricken with philosophy, any habit may be broken, given the aid of will power and science, aver prohibition proponents. In any event, as the ultimate recourse, death will come, heroic as may seem this solution by dissolution. And those who can be cured without being killed, but who lug mellowed memories with them into a drought of declining years, will find other engrossing diversions to think about —in time.

One is prompted to these reflections by the approach apace of the dry spell and by an announcement that comes to our desk out of that roaring young behemoth of cities, Chicago. We are on the eve of a period of exploiting substitutes, it seems.

Prohibition is one of the several things that have affected the beverage industries to such an extent in this year of grace, 1919, that a "Beverage Exposition" at the Coliseum in Chicago is to be held from Nov. 1 to 9. The prospectus of this unusual exposition states almost unnecessarily that this year "marks an epoch in the drink business," which is to be modified radically by "the prospective stoppage of the alcoholic drink industries."

The promoters declare the "public will stand bewildered by the novel condition and will search for new beverages that will be satisfactory. The bottlers and other retailers and the jobbers will be on the lookout for novelties in beverages that have the promise of stability in the market. The producers of beverages will be inquiring into the most efficient methods and machinery of manufacture. Food officials will be examining the new arrivals among beverages as to their wholesomeness and legality."

The exposition arrangements contemplate:

Exhibits of all types of beverages in use by the American people.

Samples of the materials employed in the production of beverages.

Machinery, implements, apparatus and devices used in the preparation of beverages.

Illustrations of the production of materials for beverages; e. g., tea plantations, dairy farms, fruit orchards, cocoa palms, mineral water wells, vineyards, etc.

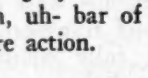
Educational exhibits by agricultural experiment stations and colleges, public food and health bureaus, etc.

Exhibits of trade and technical publications.

It is interesting to note that the so-called Beverage Exposition is being promoted by the men who arranged and managed the American Exposition of Brewing Machinery, Materials and Products in 1911.

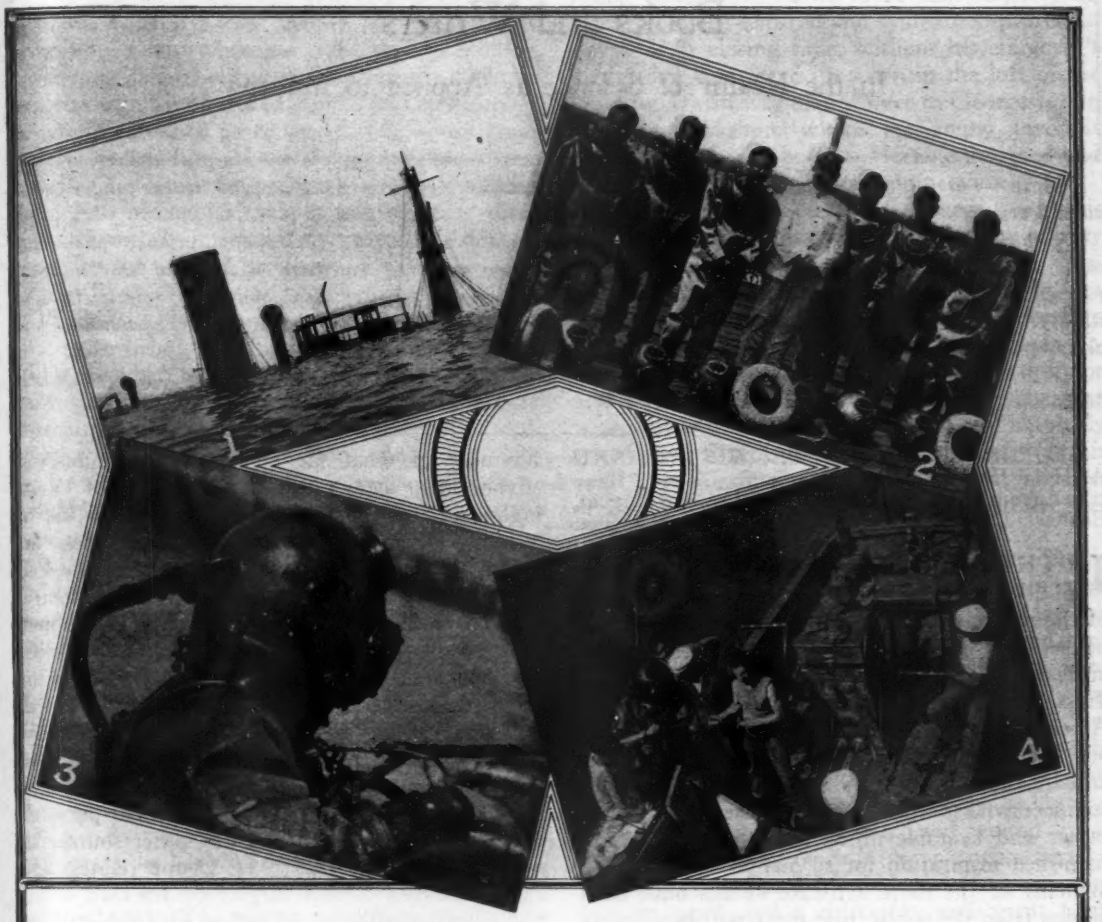
A London correspondent of the Associated Press reports that an English manufacturing company has announced that it is preparing to put on the market an automobile that can be retailed for $250 or $300. The principal material in the new flivver is to be a substance not named, but which is described as "a kind of concrete, light, but strong and durable, produced from waste material such as slag, clinkers and sawdust, and covered with a metal solution." All parts, including wheels and chassis, will be stamped out, each complete in one piece, and then fitted together. Very little wood will be used in the car, and little steel, except that requisite for the power plant and transmission. The new material, we judge, will be stamped out under heavy pressure. It suggests that the day may come when in America, with our remarkable industrial production methods, we may be able to evolve a small, light, practicable car to cost less than a motor-cycle. If the day ever comes when this car is an actual fact, and it has been much debated, the Henry Ford millenium may arrive, in which half the world will be riding in flivvers and the other half dodging 'em.

The well known Mr. Sic Semper Fidelis softly suggests in a letter to the editor of the New York *Sun* that bottles of fluid from the Brandywine River be used for the christening of war vessels at launchings after July 1. Report received and laid upon the -uh, uh- bar of naval opinion, as it were, for future action.



Charles F. Thompson, president of the Western Golf Association, boldly essays the opinion that "business is the ruin of the golfing man," and then observes, "What's the use of making money anyway? The caddies get it all eventually."

Diving Squads New Branch of the Navy



(Keystone View Co. from official photos.)

1.—SUNKEN CRAFT BEING SALVAGED BY NAVY DIVERS.
2.—CREW OF DIVING LAUNCH NO. 2 LINED UP ON DECK.
3.—NEAR VIEW OF A DIVER'S HELMET, SHOWING COMPRESSED AIR HOSE CONNECTION.
4.—DIVER AFTER BEING SUBMERGED OVER TWENTY MINUTES COMES UP TO REPORT EXTENT OF DAMAGE.

A new branch of the Navy has been developed, as an outcropping of the war, the duties of which are to salvage government vessels and to repair transports, battleships, submarines and other craft injured below the water line. Hundreds of expert divers have been trained to engage in this work, which is an uncomfortable and sometimes dangerous duty. During the war, the Navy maintained at least one of these men aboard every battleship and destroyer. When a ship was damaged through accident or torpedo a diver was sent underwater to ascertain what repairs were necessary. Many are now engaged in raising ships or in ascertaining whether they can be raised. When a diver remains below the surface more than fifteen minutes he is credited with additional pay of $1.20. When submerging he is equipped with 50-pound shoes and has a weight of 100 pounds of lead about his waist. This is to steady him against ocean currents while at work. Vew No. 4 shows how air at low compression is supplied to the diver from the surface.

Lieut.-Col. H. S. Crocker, at a dinner in his honor given at the Denver Athletic Club jointly by the American Institute of Electrical Engineers and Colorado Association of Members of the American Society of Civil Engineers, addressed these friends on the construction of the U. S. Army Supply Base at Brooklyn, N. Y., one of the largest of army engineering projects.

Books and Writers

In the Realm of Science as Applied to Industry

NOTE.—*The Editors will be glad to review in these columns American or European works under these classifications:*

Engineering; chemistry; general machinery; compressed air and its varied applications; pneumatic tools; general scientific subjects; inventions and interesting patents; maritime affairs and shipbuilding; foreign trade; international relations; industrial topics, including power, coal and steel; electricity and its applications; railroads and transportation problems; oil and gas and related matters; aviation and aerial transport; mining, minerals, metals and metallurgy.

Works submitted for review should be addressed to "Books and Writers" Editor, Compressed Air Magazine, 11 Broadway, New York, U. S. A.

GEORGE WESTINGHOUSE; HIS LIFE AND ACHIEVEMENTS, by Francis E. Leupp. Illustrated from photographs, with photogravure portrait. Boston: Little, Brown, & Company. Price, $3 net.

IN THESE columns, in January, 1911, there was published an account of one of the most notable of the public utterances of Mr. George Westinghouse, his own description of his invention of the airbrake, which was given in the course of an address he delivered at the annual meeting of the American Society of Mechanical Engineers. In our issue of April, 1914, it was our duty to pay an editorial tribute to the memory of the eminent engineer who had just passed to the beyond. The career and example of Mr. Westinghouse have furnished inspiration for so many engineers, and so many of the more intimate details have been hidden from the public, that there will be a hearty welcome for the new "Life" by Mr. Leupp from the press of Messrs. Little, Brown & Co.

It has been our genuine pleasure to scan the pages of this romantic story of the achievements of one of the greatest benefactors of the civilized world, which affords sidelights hitherto unseen. One of the foremost of American inventors, his first creation being a rotary engine at the age of fifteen, he was best known, of course, as the inventor of the automatic air brake, although his automatic railway signal occupies an equally important position as a safeguard to modern high-speed railroading. He was a pioneer, in the face of determined opposition, in introducing into America the alternating current machinery which has rendered possible the transmission of electric power for long distances, and enabled our engineers to utilize valuable watercourses which formerly ran to waste.

Mr. Leupp hopes that one day some eminent expert in technology will prepare "an adequate summary of what the whole world's industrial advancement owes to the tireless energy of Westinghouse," the mission of his own volume, as he puts it, being "simply human." Nevertheless the author, by his industry, has afforded us an excellent picture of the inventor, his work, his aspirations, his achievements. Even as the author hopes, he has conveyed to the young man of today a sense that his career will depend for success less on the splendor of its start than on the spirit in which he pursues it; far less on capital than on courage, on worry than on watchfulness, on "pull" than on persistence.

The inventor left no diaries, no files of personal correspondence and scarcely any other sources of supply for a biographer, Mr. Leupp relates, and he was obliged to rely largely on his own social acquaintance with the subject of his book, and on other friends of Mr. Westinghouse, local tradition in neighborhoods where he lived, records of courts and minutes of public meetings, partnership account books and corporate reports, in collecting his materials.

Westinghouse was born on Oct. 6, 1846, at the village of Central Bridge, N. Y., on a day when his mother had refrained from mentioning the impending event, as her husband had worked all the night before on an invention which also kept him completely absorbed in his shop all of the day when his seventh child first saw the light. The father achieved a mechanical triumph as an inventor simultaneously with the advent into the world of the child who was to bear his name and enhance it by a lasting fame.

George Westinghouse, Jr., it is to be noted, early betrayed signs of being a "chip of the old block." It was a task to keep him at his studies and he preferred of all places his father's shop, in the mysteries and delights of which he revelled.

The neighbors regarded him ("with an air of pity and wondered what was to become of so ill-promising a boy when he grew up.") Feeling any strong desire he would not brook the slightest opposition to his efforts to gratify it. Occasionally he would refuse to go to school, but would stubbornly stretch himself on the grass somewhere, and play for hours with pieces of wood, whittling them into mechanical shapes and pivoting them together with bent pins, so that they would interplay like the jointed members of a piece of machinery."

When balked the boy would fly into a rage terrifying to behold. Old neighbors of the family still remember these paroxysms, which took the form first of screaming and stamping, and then of throwing himself flat and banging his head against any hard surface that came most convenient. If those about him became obdurate he would keep up the disturbance until his strength was utterly exhausted. Usually, however, the older members of the household, unable to edure the demonstration longer, would yield the point at issue, and his tears, cries and self-torture would cease as suddenly as they had begun.

In later years, Mr. Westinghouse himself, in recalling these outbursts, remarked with whimsical humor that he had a fixed notion that what he wanted he must have. "Somehow, that idea has not entirely deserted me throughout my life. I have always known what I wanted, and how to get it. As a child, I got it by tantrums; in mature years, by hard work."

Mr. Westinghouse, Senior, moved his business to Schenectady in 1856, two partners joined him in his machinery business and the firm bought a building once used as a cement mill, on the south bank of the Erie Canal, which was turned into a shop. The main part of this is still standing and one can trace from a neighboring elevation what the elements have left of the old sign, "G. Westinghouse & Co." Young George was sent to school but did not expand mentally as his father had hoped. In spare time his father had him come into the shop and learn how tools were used by skilled hands. When watching his brother handling metal parts he would criticize and precipitate violent controversies; if left to himself at a bench, with a pattern, materials and tools at hand, his attention would soon wander and he would become immersed in some mechanism of his own contriving.

The father would occasionally gather up the "trumpery" of a little engine, a miniature water wheel and other creations and consign them all to the scrap heap. But one day when Mr. Westinghouse had thrown out an apparatus on which young George had shown more than ordinary ingenuity, a good-natured and sympathetic foreman stayed after closing time, without his employer's knowledge, and fitted up a den in the loft of the building, which was turned over to George for an amateur workshop, where the young inventor passed many happy hours. Here he designed and built his model for a rotary engine.

After a year or so he struck a bargain with his father who agreed to pay him at the rate of fifty cents a day for the time he put in at the shop. This was his first paid "job." One day when he wished to play with companions and had work to do, he rigged up a combination of tools which, attached to a power machine, would feed the pipe and automatically do the cutting he otherwise would have had to do by hand. While naturally gratified at this display of inventive ability in his son, Mr. Westinghouse became almost hopeless of converting so volatile a boy into a steady mechanic.

The youth tried to run away to exlist as a soldier in the Union Army, but was caught on board a departing train by his father just before the conductor gave the signal to go ahead and sent ignominiously back to school. His father thought the war would be over in a few months. By the summer of 1862 the situation had changed, and the boy, now nearly seventeen, reopened the subject, his father observing, "perhaps you are right, my son," and the matter was arranged. He had ambitions for a "commission" and wound up at an army recruiting office in New York where an officer gravely heard his desires. He got a gun and knapsack and a thirty-day enlistment trial, after which he insisted he was of officer calibre through experience. He was told he could have a commission if he would recruit fifty men in his own neighborhood. He only got seventeen, however, and went back into the struggle as a private becoming a corporal in the New York volunteer cavalry.

But his real desire was to get into the navy in the engineering service and on Dec. 1, 1864, by virtue of his military training and earlier mechanical training, he got a berth as Acting Third Assistant Engineer on board the *Muscoota*. Later he served in the *Stars and Stripes*, and in the Potomac flotilla. The next year he came home, the war ended, and his father was pleased to note his increased manliness. He went to work at $2 a day for his father, not long after married, and soon his opportunity came.

Young Westinghouse for some time had seen the need for an efficient railway brake. His first idea was to work it by steam, but he was obliged to give up this idea because of physical obstacles

and legal reasons. One day he bought from a young woman a copy of a magazine which described drilling by compressed air in a European mine, the air being piped 3,000 feet to the drills. Eureka! Here was the answer to his problem.

Then began his struggle. He designed a working model and tried to interest railroads in it, but with small success at first. His father declined to finance him. Eventually the Panhandle Railroad and the Pennsylvania came to agree with him on the practicability of his invention and he obtained moral and financial support from new friends in Pittsburgh. A half-million dollar company was formed of which he was president, a heavy responsibility for so young a man. In those days a company with such a capitalization was regarded as a very large undertaking.

Mr. Leupp takes us through all the stages of Mr. Westinghouse's triumphs at home and abroad, the adoption of his brake as standard equipment in America and Europe. It is a fascinating tale of human achievement and it would wrong the prospective reader of this book to tell him in advance the details of how Westinghouse won his way. His later development of the natural gas industry in Pittsburgh and its effects on that seat of manufacturing, his entry into the electrical field, his struggles in New York, the origin of the "stopper" lamp, and other momentous events in his life up to the closing scenes in 1914, are related with compelling interest.

Faulty springs in a limousine led to his taking up the matter of air springs, and an invention by Richard Liebau, a machinist of Watervliet, coming to his attention, he joined forces with Liebau, perfected the device, profitably marketed it, and left it behind him as one of his less-known enterprises.

The Rev. Dr. Samuel J. Fisher, of Pittsburgh, in his funeral sermon at the Fifth Avenue Presbyterian Church, New York, quoted the lines:

I know the night is near at hand;
The mist lies low on sea and bay;
The autumn leaves go drifting by;
But I have had my day.

George Westinghouse had had his day! He had filled every hour of it with achievement, as his biographer truly says, and the sun when it set saw him still at work. He was one of the most notable Americans of his time—a true captain of industry.

LAYING DOWN AND TAKING OFF, by Charles Desmond, author of "Naval Architecture Simplified," and "Wooden Ship Building." Illustrated. New York: The Rudder Publishing Company. Price, $2 net.

Mr. Desmond's book is the result of a series of articles published in *The Rudder,* which became so popular that the demand for copies soon exceeded the supply. It was thereupon decided to issue the materials contained in the articles in book form, with illustrations. The articles originally published came about as a result of the fact that there were so few men understanding mould loft work at the time the urgent call for ships came at the beginning of America's participation in the war.

The writer indicates that he is thoroughly versed in the subject; he has an unusual faculty of imparting his knowledge in a simple, understandable way that the reader easily grasps. The book is intended for the man who does not know, who wants to acquire the necessary knowledge and who has found most previous treatises on the subject a struggle in "the dark, void space of theory."

THE AMERICAN AIR SERVICE, by Arthur Sweetser, Sometime Captain, Air Service, United States Army, with an introduction by Newton D. Baker, Secretary of War. Illustrated from photographs. New York: D. Appleton & Company. Price, $2.50 net.

Secretary Baker in his introduction to this book, which is by no means an apology for the American aviator and his deeds of accomplishment, declares that the greatest value of the volume will lies in the fact that it is an authoritative statement of the present state of the conquest of the air. The necessities of war speeded the development of aircraft enormously. "Ten times as many years would not have produced the same advance if the years had been devoted to peaceful pursuits and commercial uses of airplanes had been the only incentive to inventors and producers. With the start now made, however, it is difficult to restrain one's forecast of the possibilities of the immediate future."

Mr. Baker's is a temperate statement of the possibilities and actualities we may expect in aviation in the next few years. The imagination, as he says, leaps at the possibilities of these developments. We cannot foresee or foretell what services these new wonders are to render to mankind. Opportunities are limitless, but as yet we can only stand by the wayside and exclaim as they go by: "My father, my father, the chariots of Israel and the horsemen thereof!"

For the first time Capt. Sweetser has given us the whole story of American military aviation, which has been largely dependent, of course, on the advancement of commercial aviation. The book covers every phase of our war programme and contains many facts new to the public, in-

cluding hitherto unpublished figures, cablegrams and other data.

Beginning with the early experiments of Langley, Capt. Sweetser traces briefly the development of aviation in America up to the entry of the United States into the war. He then shows how the Air Service was first projected as an arm of the military establishment proportioned to the other arms, and how, in response to requests from the Allies, the programme was later expanded into an attempt to create an immense independent striking force, which should not only give the supremacy of the air to the Allies, but should also constitute America's greatest contribution to their military strength.

The author then considers the separate problems of the training of the fliers, the training of the great ground forces, the production of engines, culminating in the development of the Liberty Motor, and the development of plane construction, first bringing the story down to the disruption of the air Service and the new start after "the storm of May, 1918."

At this point Capt. Sweetser examines the real meaning of the programme upon which the United States had embarked and shows its essential impossibilities. The narrative is carried forward to the signing of the armistice, not only in training and aircraft production at home but in the actual work of the Air Service overseas.

The exceedingly interesting concluding chapters deal with the work of the fliers in the United States, including the establishment of the Air Mail Service, the organization of the Air Service in France, and the achievements of the American aviators and balloon men at the front.

The author's valuable contribution to aviation literature will have an appeal for the layman as well as the aviator and will stand as a work of historical value to which all future writers will be obliged to refer. It is carefully indexed for the guidance of those seeking references to particular subjects and will prove of great value to those concerned with dates and facts. It bristles with figures and data to be found in no other work on the subject that has come to our attention.

PUMPING MACHINERY, a Treatise on the History, Design, Construction and Operation of Various Forms of Pumps, by Arthur M. Greene, Jr., Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute; Sometime Junior Dean, School of Engineering, University of Missouri. Illustrated. Second edition, revised. 8vo, vi-703 pages, 504 figures. Price, cloth, $4 net.

Professor Greene delivered some seven years ago a course of lectures to the mechanical engineering students at the University of Missouri, which has become the basis for an excellent book covering the field of pumps much as he had mapped out his original student's course. The author's general plan in the work is to give a brief historical outline of the pump, one of the oldest machines known to man, and which latterly has been closely connected with the history of the steam engine, following this with an examination and description of the action of a number of common forms of pumps, showing methods of design.

This book is primarily suited to the use of those who have studied hydraulics, mechanics, and the strength of materials. Its announced purpose is to develop certain general principles of mechanics which are applicable to pumping machinery, as well as to train the student in application of certain of the theoretical portions of the studies of an engineering course.

The two opening chapters are devoted to the development of pumping machinery, since the author feels that all engineers need a more intimate knowledge of the early members of his profession. The pump is so closely allied with the steam engine in early times that this history traces the early forms of that machine. Descriptive chapters on modern pumps have been prepared from the catalogues and bulletins of manufacturers and from current technical literature.

Professor Greene's painstaking work forms for the student a reference book which will not only give him the peculiarities of the different forms of special pumps, but the dimensions and other data by which he may know what size of pump may be had for a certain purpose. Modern reciprocating pumps and simplex pumps are described in considerable detail, together with tests of pumping engines.

The author devotes a chapter to air-lift pumps and pneumatic pumps which readers of COMPRESSED AIR MAGAZINE will find of especial value and interest. Centrifugal and mine pumps are considered in the closing chapters. James P. Frizell patented the air lift pump in 1880 and Pohle took out a patent in 1886, although these two, as the author notes, were by no means the first records of this type of pump. The air-lift chapter is illustrated with drawings and mathematical formulae for the guidance of the reader.

The entire work, revised in this second edition, is one that will readily commend itself to students, instructors and to those interested in general pump practice.

THE SHIPBUILDING INDUSTRY, by Roy Willmarth Kelly, Director, Harvard Bureau of Vocational Guidance, author of "Hiring the Worker," and Frederick J. Allen. Assistant Director, Harvard

Bureau of Vocational Guidance, author of "The Shoe Industry." With an introduction by Charles M. Schwab. Boston and New York: Houghton Mifflin Company. Illustrated. Price, $3 net.

BEFORE the Great War, the United States was almost a nonentity among the maritime nations. We carried millions of tons of freight annually in our own ships, but these vessels plied the waters of the Great Lakes. We had only a hand full of ships on the high seas. When we entered the war Germany scoffed at us. Her military leaders declared we could not muster more than a few thousand capable shipyard workers, that we had no plants worth mentioning and that it would be many years before we could produce enough ships to make a dent as a contender in the war.

Looking at us from the enemy's viewpoint these indictments of unpreparedness appeared to be true. From our own standpoint they were too true for comfort. But we did not know our own strength in the industries, in powers for fast organization, in illimitable energy to produce under pressure. Much less did a blind, stubborn and cynical enemy realize our inherent strength. A hasty survey of the possibilities as to shipyard workers that might be mustered seemed to indicate that there might be available some 50,000 men, more or less skilled, for this purpose. But when we had gotten busy in overalls we had 500,000 men at work on ships!

Great Britain and Germany were the shipbuilding leaders before the war. The United States can now almost equal the output of Britain and Germany combined. We are the world's leader in shipbuilding, or at least have the equipment to be. In addition, we are rapidly on the way to being the world's leading maritime power.

How this has all come about is narrated graphically in a Houghton Mifflin book, "The Shipbuilding Industry," written by Messrs. Kelly and Allen, an authoritative work compiled as to its stated facts with the assistance of the U. S. Shipping Board and prefaced by a brief introduction from the pen of Mr. Charles M. Schwab. The book was published last year, but to this time it had not been our privilege to read it. It tells the governing circumstances that pertained to the crucial problem of tonnage, and shows how we won the race with the German U-boat, an achievement of which all America is proud.

The authors without exaggeration state that the future of civilization depended upon the success of the most tremendous industrial movement the world ever knew, carried on under the leadership of one of the most forceful of American captains of industry, and backed by the resources of the world's richest and potentially most powerful nation. The entire narrative, from the apparently almost hopeless and desperate beginning of our new shipbuilding industry, to the time of its actual achievements, is told interestingly and with authority. A knowledge of the facts this notable book contains is highly desirable for every American who wishes to see his country maintain her position in ship construction and ship owning.

GAS, GASOLINE AND OIL ENGINES, by A. Frederick Collins. Illustrated. New York: D. Appleton & Company. Price, $1.25 net.

Mr. Collins has turned out a decidedly utilitarian volume, which is a necessary work for those using engines, no matter of what type, and it is a helpful guide to anyone who wants to know what kind of engine to buy for a given purpose. The work tells the reader almost anything he wishes to know about engines, from the *barrel* of the earliest cannon to the present day high-powered engines of various types. It answers questions and conjures up things to which you have doubtless never even given thought.

In his customary easy-flowing style, the author shows just how engines are made and how to use and repair them. The theory of internal combustion is clearly explained. Gas, gasoline, oil and Diesel engines are then taken up, followed by a discussion of the uses and possibilities of the cylinder-fired engine.

One of the most valuable portions of the book is that which is devoted to engine economy. Helpful instructions are given here on how to save fuel, how to tell the different "diseases" to which an engine is subject and what treatment to use in each case. Power transmission is also treated clearly and interestingly.

We are glad to commend Mr. Collins' handy volume, which should have a place on the book shelf of every engine man.

We are in receipt of the first issue of *Du Pont Products,* a new monthly review of the du Pont activities, which is for distribution in foreign markets. This publication, a monthly, of which C. de Cordero is the managing editor, is published at No. 120, Broadway, New York, its subscription price being one dollar a year. The letterpress and illustrations are handsome and effective and the text of the initial number contains a highly interesting history of the du Pont company. Attractively described are a number of the bi-products of the great du Pont factories, together with suggestions respecting their uses. This newcomer in the field of export business lit-

erature is an apparently worthy evidence of the traditions of the great house behind it.

In a world of print where the types too frequently play pranks, there is noted atop the book review column of our neighbor, *The Literary Digest*:

RECENT FRICTION

Franklin P. Adams, of *The Tribune,* hitting on this linotype lapse, declares *The Digest* has carried its spelling reform far enough!

—F. J. T.

PUBLICATIONS RECEIVED

THE SHIPBUILDING INDUSTRY, by Roy Willmarth Kelly and Frederick J. Allen, with an introduction by Charles M. Schwab. Boston and New York: Houghton Mifflin Company. See review.

PUMPING MACHINERY, by Arthur M. Greene, Jr. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. See review.

PRICES DURING THE WAR AND THE READJUSTMENT PERIOD, by T. S. Holden. Issued by the U. S. Department of Labor Information and Education Service, through its Division of Public Works and Construction Developments. Reprint of an address before the New York Chapter of the American Institute of Architects. Washington: Government Printing Office.

GEORGE WESTINGHOUSE; HIS LIFE AND ACHIEVEMENTS, by Francis E. Leupp. Boston: Little, Brown, & Company. See review.

GAS, GASOLINE AND OIL ENGINES, by A. Frederick Collins. New York: D. Appleton & Company. See review.

LAYING DOWN AND TAKING OFF, by Charles Desmond. New York: The Rudder Publishing Company. See review.

THE AMERICAN AIR SERVICE, by Arthur Sweetser, New York and London: D. Appleton & Company. See review.

JOHNSON'S MATERIALS OF CONSTRUCTION, by M. O. Withey and James Aston, edited by F. E. Turneaure. Rewritten, fifth edition. Illustrated. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Review in July issue.

TRAINING FOR THE ELECTRIC RAILWAY BUSINESS, by C. B. Fairchild, Jr., Executive Assistant, Philadelphia Rapid Transit Company. Written under the supervision of T. E. Mitten, Chairman, Executive Committee, Philadelphia Rapid Transit Company. Illustrated with photographs and three charts. Philadelphia and London: J. B. Lippincott Company. Price, cloth, $1.50 net. To be reviewed in July issue.

ZELNICKER'S BULLETIN, Walter A. Zelnicker Supply Co., St. Louis, Mo. No. 258, containing list of rails and accessories in stock.

NELSON'S PERPETUAL LOOSE-LEAF ENCYCLOPAEDIA (specimen pages) John H. Finley, LL.D., Editor-in-Chief. 12 volumes, with 7,000 illustrations, colored plates, colored maps and engravings. We acknowledge special articles for review in July issue.

INDUSTRIAL TRAINING AND FOREIGN TRADE, Bulletin No. 7 of the United States Training Service of the Department of Labor, C. T. Clayton, Director. Washington: Government Printing Office.

COMMERCE AND FINANCE, for May 7, 1919. Edited by Theodore H. Price.

GOVERNMENT PROTECTION OF FOREIGN INVESTMENTS, by Albert Breton, Vice President, Guaranty Trust Co., New York, reprinted from *Scribner's Magazine,* Foreign Trade Department.

LABOR TURNOVER AND INDUSTRIAL TRAINING, Bulletin No. 6 of the United States Training Service of the Department of Labor, C. T. Clayton, Director. Washington: Government Printing Office.

RONALD PRESTIGE, for May, Thomas R. Stewart, Editor. The house journal of the Ronald Press Co., New York.

EXPORT TRADE for April 26, 1919. Vol. 1, No. 5, edited by Laurance T. Clark. New York: Ashwell Davis & Co., Inc.

THE CORN EXCHANGE, Vol. 5, No. 12, the house journal of the Corn Exchange National Bank, Philadelphia.

NOVO-POWER, Vol. 2, No. 2, the house journal of the Novo Engine Co., Lansing, Mich.

TRAINING LABOR FOR PEACE TIME, Bulletin No. 5 of the United States Training Service of the Department of Labor. Washington: Government Printing Office.

VAN NOSTRAND'S RECORD OF SCIENTIFIC LITERATURE, Vol. 36, No. 10. Publisher's Bulletin. New York: D. Van Nostrand Company.

MONTHLY BULLETIN OF BOOKS, May, 1919. Publisher's announcement. New York: The Baker & Taylor Co.

HOG ISLAND NEWS, Vol. 2, No. 19. House journal of the American International Shipbuilding Corporation, B. F. Doran, Editor.

SKETCH OF BRUNO V. NORDBERG

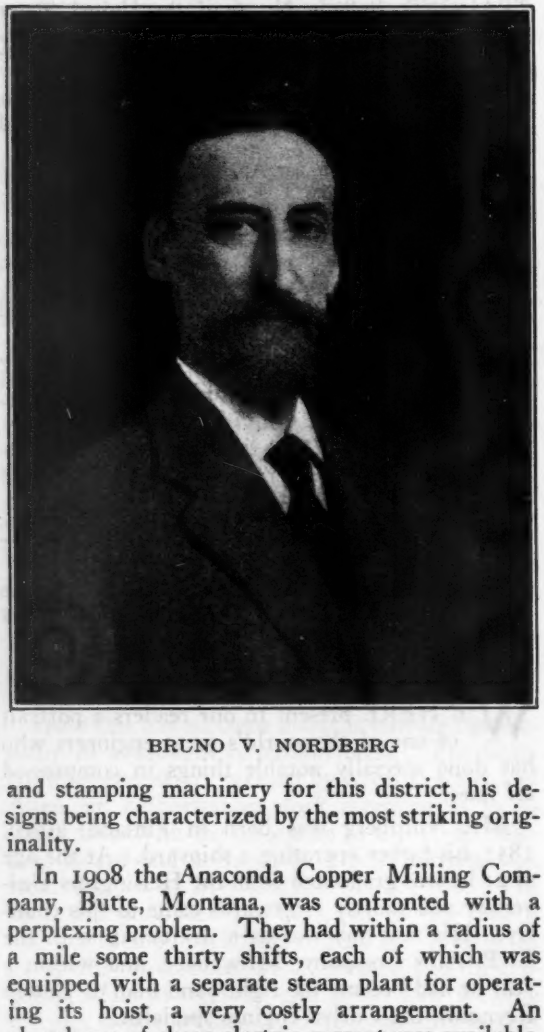
WE HERE present to our readers a portrait of one of the world's great engineers who has done specially notable things in compressed air lines.

Mr. Nordberg was born in Finland, April, 1857, his father operating a shipyard. At the age of 21 he was graduated from the Helsingfors University and shortly afterwards came to this country. His first job was as a draftsman with the E. P. Allis Company, Milwaukee, and within a year he had become the right hand man of Edwin Reynolds, the Corliss engines specialist.

In 1889, Mr. Nordberg established his own concern with a force of six men. In 1892 he built his first steam engine for a Milwaukee brewery and his company became a pioneer American builder of the present type of poppet valve engine.

Subsequently he took up the general manufacture of pumps, Corliss engines, hoists and compressors. In 1899 he designed a pumping engine with a new steam cycle which achieved noteworthy results, increasing the steam engine efficiency beyond the limits before attainable.

He early gained the confidence of the mining men in the copper mines of the Michigan Upper Peninsula, due to his ability to solve successfully problems related to mining machinery and for a number of years his time was largely devoted to designing efficient hoisting, pumping, compressing



BRUNO V. NORDBERG

and stamping machinery for this district, his designs being characterized by the most striking originality.

In 1908 the Anaconda Copper Milling Company, Butte, Montana, was confronted with a perplexing problem. They had within a radius of a mile some thirty shifts, each of which was equipped with a separate steam plant for operating its hoist, a very costly arrangement. An abundance of cheap electric current was available, but electric hoists were not satisfactory and Nordberg designed and carried to complete success perhaps the most notable compressed air installation in the world. This was described in COMPRESSED AIR MAGAZINE soon after the event.

Electric driven air compressors were installed, arranged to be started without the use of electricity, thus eliminating the starting parts. These compressors were connected up to a battery of air receivers in which a constant pressure was maintained by means of a static head, furnished by a take located at a sufficient height. Air was piped to the different shafts through a line forming a loop, and air operated hoists—the converted steam hoists—arranged to use the air economically were installed at each shaft. At each hoist a reheater was placed to heat the air before it was used. The entire system was a most radical departure from all familiar practice and was a complete success.

To meet requirements in the Michigan district, Mr. Nordberg designed an extremely large cylindro-conical drum hoist which became a standard design. He is now building a hoist to operate at a maximum depth of 10,000 feet for this district.

During the war Mr. Nordberg was building 1400-hp. vertical triple expansion engines for new ships of the Emergency Fleet Corporation, also special compressors for inflammable gases and machinery for liquifying gases.

Mr. Nordberg has been an active member of the American Society of Mechanical Engineers, contributing valuable papers to its transactions. Outside of engineering circles he is extremely retiring and quiet, but active and alert at his work.

Sailing does lure him away for a two or three weeks' annual cruise about Lake Michigan; he has owned a trim 62-ft. schooner, "Merlin," for 16 years. And sailing, he says, is a splendid sport for the engineer, an avocation affording possibilities seldom accorded it. To Mr. Nordberg it recalls the sport of his youth, sailing about the shores of the Baltic Sea and the Gulf of Bothnia.

Notes of Industry

A Sheffield (England) firm has converted its airplane factory into a plant for the manufacture of small-scale model locomotives and steam engines, which were formerly imported from Germany to the extent of over $4,000,000 annually. Its output will consist of two classes of models, the expensive educational toy and a small engine for workshop use. Each is made exactly to scale and embodies the principles of a full-sized locomotive.

Gas is proving a troublesome problem in Comanche county (Oklahoma) and it looks as though the producers there will have to install casinghead gas plants in self defense, as the

state law prevents the waste of gas, and many of the wells won't produce oil till they have blown several hundred million feet of gas off.

In a brief note on tides *Marine Engineering of Canada* draws attention to the infrequently appreciated effect of atmospheric pressure on the magnitude of the tidal wave, saying that if the barometer falls one inch the water rises a foot and a-half. This, of course, is only the case if the barometric disturbance is comparatively local.

It has been officially stated that an 8½ in. cross compound air compressor (air brake pump) will produce approximately three times as much air as will a 9½ in. simple air compressor, and approximately twice as much air as an 11 in. simple air compressor, while the pounds of steam used per 100 cubic feet of air is approximately one-third as much in a cross compound pump as in the simple types.

The headquarters of the Eastern Department Office of the Air Service of the United States, 104 Broad street, New York City, has announced that 15,000 men are wanted for the Air Service at once, and requests enlistments for one to three years, without further obligation to military service. Attention is called to the value of the training to become a pilot or an expert aviation mechanic. Further information may be obtained by applying to the Department Air Service Officer, 104 Broad street, New York City.

A tunnel under the Shimonoseki Strait between the islands of Moji and Kiushu of the Japanese archipelago is one of the newest undertakings up for consideration, although this project has been proposed previously. The tunnel would be 3½ miles long, of which 1 mile would be under the water. The project will cost $8,973,000 to $9,970,000 and require 10 years' time. It has been placed in charge of Doctor Tanabe, who is connected with the engineering college of the Imperial University, Kyoto.

As an indication of the German activities for regaining their trade in the future, it may be mentioned that one large German electrical company has purchased fifteen acres of land just outside of the city of Malmö, in the southern part of Sweden, with the intention of erecting a factory on this site. According to the *Swedish-American Trade Journal*, at least six other German firms have taken similar steps.

A paper read by Mr. T. J. Querette, of the North-East Coast Institution of Engineers, Newcastle-on-Tyne, shows that reinforced concrete vessels of 1000 tons deadweight are 39 per cent. heavier than steel vessels of the same size. With 2000-ton ships the increase is 25.8 per cent.; for 4000 tons 16.5 per cent., and for 6000-ton ships the increase in displacement falls to 11.8 per cent.

It is a remarkable indication of the trend of events that Yarrow and Co., Limited, intend gradually to diminish their output on the Clyde, and increase their output in their works at Vancouver, on the Pacific Coast of North America.

The construction of concrete rolling stock for railroads is under way in Holland. It is stated that only the wheels, axles, buffers and couplings are made of steel, which can only be accepted as an absurd overstatement of the facts. The weight of the cars of the new type is said to be no greater than that of steel cars, the construction is simpler and cheaper and the upkeep light.

A Dutch engineer has evolved a new method of freeing boiler feed water of oil. He subjects the water to the action of 110-volt continuous current, which causes the oil particles to combine into larger masses, after which they are removed by pressure filters.

Where concrete is rammed with a heavy pneumatic rammer, operations may sometimes be considerably facilitated by counter-balancing the rammer and suspending it from an overhead sheave.

The American Institute of Mining and Metallurgical Engineers will hold its convention in Chicago, Sept. 22 to 26. This meeting promises to be one of decided importance to the industry, as subjects of concern in iron and steel will be under discussion. In addition to the technical program excursions are being arranged to the steel mills at Gary, the oil refineries at Whiting, metallurgical plants at East Chicago and North Chicago, and to the La Salle district where the cement, coal and zinc industries are represented.

The Meteorological Section of the Royal Air Force has dispatched an expedition to take "soundings" of the atmosphere over the Atlantic. Every six hours instruments will be sent up by means of kites to determine altitude, humidity, temperature and wind force at heights of 1000 ft., 2000 ft. and 3000 ft. It is expected that the investigations will occupy five weeks.

Piping that is used to carry acetylene or hydrogen should be painted a distinctive color so

that it will not be possible to mistake the line for anything else. The infrequent use of piping for such special service renders the precaution more imperative.

Soldiers, sailors and marines recently discharged can avail themselves of an unusual opportunity at the Wentworth Institute, located at Huntington Avenue, Boston, Mass. This Institue is providing four-months' trade courses in printing, plumbing, machine work, pattern making, carpentry, etc., and not only are the courses free, but housing and board are also provided without cost to the men. The courses are similar to those given last summer to soldiers being trained as mechanicians for the Army.

Owing to the scarcity of timber and steel during the war, the gates for a private dry dock in England were made of reinforced concrete. The dock is 40 feet wide and the gates are 14 feet deep. They are circular in form and despite the 14-foot head of water, are only 3½ inches thick. No waterproofing compound was employed and yet they are said to be perfectly water-tight.

Disposition of the surplus stocks of lead owned by the War Department is being made at current local market prices in the community in which the surplus is held. This surplus is scattered throughout the country, and in no one place is there a large quantity. Reports from the various bureaus show a total amount of 7000 tons of lead to be in possession of the War Department. This surplus of 7000 tons represents but a small percentage of the year's production of lead and is not sufficient in quantity to affect the market in any way.

The United States has only six per cent. of the population of the world and only seven per cent. of the land, and yet we produce:

Of copper	60%	Of the world's supply
" lead	40%	
" zinc	50%	
" aluminum	60%	
" oil	66%	
" corn	75%	
" cotton	60%	
" silver	40%	
" coal	52%	
" gold	20%	
" iron and steel	40%	
" automobiles	85%	
" wheat	25%	

and refine 80 per cent. of the copper and operate 40 per cent. of the world's railroads.

Personal Intelligence

EDITOR'S NOTE—Authentic items of personal intelligence from the industrial fields in which compressed air and pneumatic tools and devices are employed will gladly be received for publication in these columns. Such news paragraphs should be mailed to Editorial Department, Compressed Air Magazine, No. 11, Broadway, New York, by the first day of the month preceding date of publication.

At the annual meeting of the Standard Gas & Electric Company's stockholders, these directors were re-elected: H. M. Byllesby, A. S. Huey, O. E. Osthoff, J. J. O'Brien, George H. Harries, R. J. Graf, D. T. Flynn, W. H. Clarke, S. W. Childs, B. E. Sunny, F. W. Stehr, John H. Roemer, Donald McDonald, Elmer Dover and W. R. Thompson.

* * * *

Nicholas J. Cunningham, executive secretary for 16 years of the Springfield (Mo.) Gas & Electric Co. and the Springfield Traction Co., has resigned to devote his energies to developing his large oil acreage in McCulloch county, Texas. Mr. Cunningham has been engaged in the public utilities field since 1903.

* * * *

Robert Bryce, of Toronto, has been elected a councilor of the Canadian Mining Institute.

* * * *

L. D. Davenport, chief engineer of the Oliver Iron Mining Co. in the Hibbing district, has returned from a pleasure trip in California.

* * * *

W. J. Hamilton, consulting engineer of the Cerro de Pasco Copper Co., together with J. M. Boutwell, consulting geologist and C. V. Drew, has sailed from New York for Lima.

* * * *

Paul Cowan and Harry Akard of the Bristol (Tenn.) Gas & Electric Co. have entered the service of Messrs. Henry L. Doherty & Co. of New York at Bartlesville, Okla.

* * * *

Julian T. Dixon, paymaster of the Republic Iron & Steel Co., died recently at his home in Birmingham, Ala. He had been with the company 19 years.

* * * *

Edward Leonce Dufourcq, long actively engaged as a prominent mining engineer in developing properties in South and Central America, Mexico and the United States, was murdered recently by bandits in Mexico. For the last two years he had been connected with the Teziutlan Copper Co. of New York, as assistant general

manager at Teziutlan, State of Pueblo. While testing a new gasoline-driven motor car on the company's railroad line about four miles from the mine in company with Orme Gaisman, a Swiss engineer, he was set upon by the outlaws. Employees found his lifeless body next day. Mr. Dufourcq was born in 1870 and was graduated from Columbia University. For ten years he had been a member of the American Instiute of Mining and Metallurgical Engineers. He left a widow and a daughter by a former marriage.

* * * *

Col. Duncan N. Hood is in charge of the new Buenos Aires office of the McGraw-Hill Co., Inc., at Calle Corrientes, 685.

* * * *

T. J. Hudson has been appointed acting manager of the pneumatic tool sales division of the Chicago Pneumatic Tool Co., succeeding F. H. Waldron, who returned to Minneapolis, Minn., as district sales manager.

* * * *

T. E. Doremus has been transferred by E. I. duPont de Nemours & Co. to the E. I. duPont de Nemours Export Company as general eastern manager with headquarters at Shanghai.

* * * *

E. H. Myers, Jr., W. A. Channes, W. B. Weston, M. C. Row, and Edgar Berry, all of Tulsa, Okla., have formed the Myers Oil & Gas Corporation with a capitalization of $250,000.

* * * *

I. T. Williams has been appointed general manager of the London & Northwestern Railway, of England, succeeding Sir Guy Calthrop, deceased.

* * * *

A. A. Woods, formerly superintendent of the New Orleans & Northeastern R. R., has been appointed chief engineer of the Southern R. R. with headquarters at Cincinnati, succeeding Curtis Dougherty, deceased.

* * * *

Howland Bancroft and B. L. Thane have formed a partnership as consulting engineers with offices in the Crocker Bldg., San Francisco.

* * * *

William Beaudry, director and manager of the Stewart Mining Co. and of the Nabob Consolidated Mining Co., at Kellogg, Idaho, has resigned.

* * * *

J. R. Buchanan has been discharged from the Army as Captain of Engineers, and has resumed his position with the Homestead Iron Dyke Mines Co., at Homestead, Oregon.

W. B. Devereux, Jr., Major in the Air Service, has returned from overseas and received his discharge. He will resume his work with the firm of Wilkens & Devereux, in New York.

* * * *

Theodore J. Hoover has been appointed Dean of the Mining Department of Stanford University, to take effect on October 1. He will organize the department on the basis of graduate study.

* * * *

George W. Blackinton, Major in the A. E. F., formerly office manager at Denver for the Sullivan Machinery Co., has been awarded the D. S. C. for extraordinary heroism at Xammes, France, on September 12, 1918.

* * * *

H. E. T. Haultain, professor of mining in the University of Toronto, has been placed in charge of the Vocational Training Branch of the Department of Soldiers' Civil Re-establishment. The entire department is under the direction of W. E. Segsworth, a mining engineer of Toronto.

* * * *

Amor F. Keene has accepted the position as consulting engineer and a member of the New York advisory committee of the Gold Fields American Development Co., which is associated with the Consolidated Gold Fields of. South Africa.

* * * *

Claude Cooper, recently returned from overseas service as Captain in the U. S. Army, has been named as superintendent of the Calumet & Hecla electrolytic plant at Hubbell, Michigan, succeeding J. C. Bryant. Mr. Cooper was formerly asssitant-superintendent of the C. & H. smelting-plant.

* * * *

The Chicago Pneumatic Tool Co.'s Boston office has been moved to No. 182, High street, and is under the management of F. S. Eggleston. The company also announces it has opened two new offices in the Southwest, one at Tulsa, Okla., and the other at El Dorado, Kansas.

* * * *

J. I. Edwards has been appointed special foreign representative of the Chicago Pneumatic Tool Co. and is leaving for Europe.

* * * *

Two new district managers for the Chicago Pneumatic Tool Co. are J. K. Haigh at San Francisco and Nelson B. Gatch at Minneapolis.

* * * *

Following his discharge from the United States Army, Edward N. Hay has joined the engineer-

ing firm of Robert T. Pollock Company, Boston.

* * * *

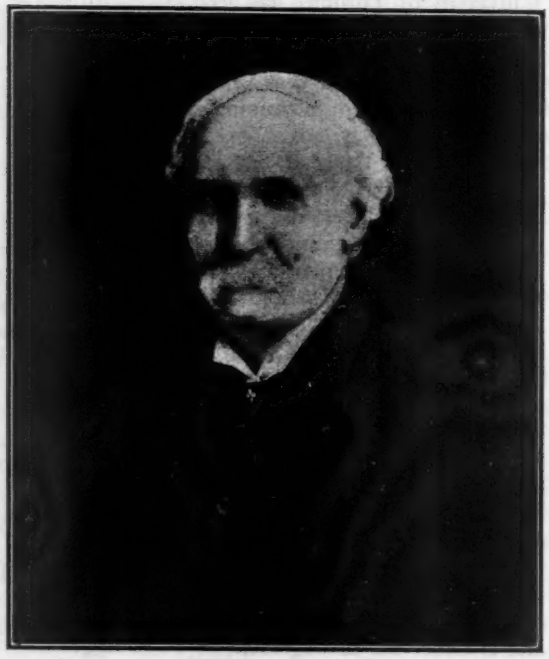
M. L. Rogers, T. A. Irwin and W. G. Singer of Wilmington, Del., have formed the Hadley Oil Company, with a capitalization of $240,000.

* * * *

J. E. Toliver of Colorado Springs, Col., and E. J. Lambert and E. E. Feistel of Tulsa, Okla., have incorporated the Lambert-Toliver Oil & Gas Co. with a capital of $300,000.

* * * *

Charles B. Richards, Emeritus Professor of Mechanical Engineering at Yale University, died recently at his home in New Haven in his 86th year, after a long and distinguished career. Born in Brooklyn, where he was educated, he became associated with the late Charles T. Porter, later



CHARLES B. RICHARDS.

establishing himself as a designer of machinery. It was through the insistence of Mr. Porter that he finally perfected his celebrated high speed Richards Indicator. He refused to patent it, saying that if he "patented everything he thought of he would soon be in the poorhouse." He finally agreed to sell his right in the invention to Mr. Porter for $100, Porter to patent it and to employ him to obtain the patent. For the achievement of inventing the indicator he was made a Chevalier of the Legion of Honor of France. For many years he was consulting engineer of the Colt's Patent Fire Arms Co., Hartford, and while there designed and built in 1867 two pairs of Porter-Allen engines which are still furnishing power to the older part of that establishment. Leaving a post as superintendent of the Southwark Foundry & Machine Co., Philadelphia, in 1884, he occupied his chair at Yale until 1909, since which time he had been professor emeritus. He was U. S. Commissioner to the Paris Exposition in 1889 and was a fellow of many societies.

* * * *

Capt. Geo. Sykes, R. A. F., A. M. I. E. E., for four years a commercial attache of the British War Mission in this country, sailed in May for London to become London manager of the engineering and railroad departments of Messrs. Dutilh-Smith McMillan Co. For several years before the war Capt. Sykes was engaged in electrical engineering lines and with power and traction interests. His London address will be Central Building, Totehill street, Westminster, where he will be pleased to see American friends.

Latest U. S. Patents

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

MARCH 4.

1,295,889. PRESSURE-GAGE FOR TIRES. Benjamin G. Gilbough, Los Angeles, Cal.

1,295,947. COMPRESSOR. Fred W. Wolfe, Chicago, Ill.

1,295,981. COMBINED CENTRIFUGAL AND AIR-LIFT PUMP. Carl Hallauer, Los Angeles, Cal.

1,295,991. AIR-PUMP FOR AUTOMOBILES. George W. Kellogg, Rochester, N. Y.

1,296,012. REFRIGERATION APPARATUS. Edwin R. Sage, Jersey City, N. J.

1,296,079. VACUUM LIFTING APPARATUS. Halbert K. Hitchcock, Pittsburgh, Pa., and William J. Golightly, Kokomo, Ind.

1,296,107. CALKING AND GLAZING DEVICE. Orley R. Oakley, Decatur, Ill.

1,296,121. SUCTION-CLEANER. William W. Rosenfield, New York, N. Y.

1,296,190. APPARATUS FOR THE CONCENTRATION OF ORES. James M. Hyde, Palo Alto, Cal.

1,296,312. TUNNEL-SHIELD. John F. O'Rourke, New York, N. Y.

1,296,315. AIR-WASHING APPARATUS. William D. Philips, Brooklyn, N. Y.

1,296,359. PNEUMATIC MAT. Daniel Webster Brown, Youngstown, Ohio.

1,296,363. FUEL-FEEDING DEVICE FOR INTERNAL-COMBUSTION ENGINES. Charles S. Burton, Oak Park, Ill.

1,296,443. AIR-COOLING SYSTEM FOR INTER-

NAL-COMBUSTION MOTORS. Horace W. Turner, Wilmington, Del.

1,296,524. VACUUM FUEL-FEED DEVICE. Webb Jay, Chicago, Ill.

1,296,526. VACUUM-OPERATING LOCK. George C. Jensen, Oakland, Cal.

MARCH 11.

1,296,657. PRESSURE-REGULATOR. Theodore A. Hammond, Passaic, N. J.

1,296,735. INTERNAL-COMBUSTION-ENGINE VACUUM ACTUATING MEANS. Samuel F. Arbuckle, Indianapolis, Ind.

1,296,828. HYDROTURBINE VACUUM-PUMP. Edward F. McCarthy, Chicago, Ill.

1,296,869. BLOW-TORCH. Leon U. Snow, Lincoln, Neb.

1,296,926. APPARATUS FOR PRODUCING COMMINUTED MATERIAL. John W. Cox, Erie, Pa.

3. In an apparatus for producing comminuted material, the combination of devices for conveying the material and directing the same to fall by gravity in an open stream across an air passage; means for creating a current of air through the passage and falling material, comprising a fan; pipes connecting the fan with the inlet and outlet of said passage; and a separator arranged in the pipe circuit.

1,296,968. METHOD OF SUPPLYING AIR TO INTERIORS. Albert R. Klein, New York, N. Y.

1,297,005. AUTOMATIC CONTROL FOR VACUUM-PUMPS OR THE LIKE. Frank R. Perry, Chicago, Ill.

1,297,130. SYSTEM OF SHIP PROPULSION. William L. R. Emmet, Schenectady, N. Y.

1,297,165. AIR-BRAKE FOR AUTOMOBILES. George C. Higbee, Tekoa, Wash.

1,297,191. VENTILATING APPARATUS FOR MINES. Daniel F. Lepley, Connellsville, Pa.

1,297,223. SAND-BLAST APPARATUS. William P. Mott, Chicago, Ill.

MARCH 18.

1,297,374. GAS-BURNING APPLIANCE. Elmer T. Lutz, Kansas City, Mo.

1,297,422. ELECTROPNEUMATIC BRAKE. Walter V. Turner, Wilkinsburg, Pa.

1,297,437. STRAIGHT-AIR ONE-MAN EQUIPMENT. Joseph M. Bosenbury, Peoria, Ill.

1,297,508-20. FLUID-PRESSURE BRAKE. Walter V. Turner, Wilkinsburg, Pa.

1,297,535. PNEUMATIC TRIGGER-PULL FOR FIREARMS. Alexander Boynton, U. S. National Army.

1. A firearm containing firing mechanism with a manual trigger, and having pneumatically actuated means operatively connected with the firing mechanism and not with the trigger, to normally actuate said firing mechanism independently of the trigger, leaving said trigger unobstructed for the free application of the finger for manual operation of the firearm at times when a pneumatic impulse cannot be conveniently applied to said firing mechanism by said means.

1,297,679. PNEUMATIC TOOL. Charles H. Haeseler, Philadelphia, Pa.

1,297,687. PNEUMATIC SWITCH. William E. Haskell, Brattleboro, Vt.

1,297,692. ROTARY COMPRESSOR. Irving C. Jennings, South Norwalk, Conn

1,297,693. ROTARY FLUID-PRESSURE DEVICE. Otto W. Johnson, San Francisco, Cal.

1,297,706. GLASS-BLOWING MACHINE. James W. Lynch, East St. Louis, Ill.

1,297,716. PROCESS OF OZONING SUBSTANCES. Alfred J. Moisant, New York, N. Y.

1,297,803. ELASTIC-FLUID TURBINE. Harvey N. Davis, Cambridge, Mass.

1,297,855. VACUUM-DISTRIBUTER FOR INTERNAL-COMBUSTION ENGINES. Samuel D. Irwin, Floydada, Tex.

1,297,864. ELASTIC-FLUID TURBINE. William L. King, Cincinnati, Ohio.

1,297,878. ELASTIC-FLUID TURBINE. William J. A. London, Springfield, Mass.

1,297,884. AIR-BRAKE SYSTEM. George Macloskie, Erie, Pa.

1,297,924. AIR-DUMPING BALLAST-CAR. Thomas N. Solomon and Harry D. Solomon, Detroit, Mich.

1,297,958. GAS AND AIR MIXING DEVICE. Edward C. Wulfeck, Cincinnati, Ohio.

1,297,981. AUTOMATIC GLASS GATHERING AND BLOWING MACHINE. Arthur Wilzin, St. Ouen, France.

MARCH 25.

1,297,999. PNEUMATIC BRAKE AND CLUTCH CONTROLLER FOR AUTOMOBILES. Corwin W. Bryant, Minneapolis, Minn.

1,298,111. VACUUM-PUMP. Charles Neville Sowden, Central Caracas, Cuba.

1,298,113. PLAYER-PIANO PNEUMATIC. Charles H. Spencer, Baltimore, Md.

1,298,195. FLUID-LINE-PRESSURE-REGULATING VALVE. Edward J. Fries and Thomas F. Dickey, Toledo, Ohio.

1,298,291. GOVERNOR FOR AIR-MOTORS. Melville Clark, Chicago, Ill.

1,298,491. PNEUMATIC ACTION FOR PIANO-PLAYERS. Archibald Eaton Goldspink, Kentish Town, London, England.

1,298,557. AIR STARTING MEANS FOR INTERNAL-COMBUSTION ENGINES. Otto F. Persson, Erie, Pa.

APRIL 1.

1,298,655. SYSTEM OF AIR DISTRIBUTION. Emil A. Briner, East Orange, N. J.

1,298,664. VACUUM-PUMP. Lewis W. Chubb, Edgewood Park, Pa.

1,298,742. SUBAQUEOUS TUNNELING. Frank D. Leffingwell, Montclair, N. J.

1,298,880. SUBAQUEOUS TORCH AND METHOD OF IGNITING. Friedrich Wilhelm Brusch and Walter Franz Josef Beyer, Dortmund, Germany.

1,298,903. VACUUM SYSTEM. Carl R. Daellenbach, Ellwood City, Pa.

1,299,059. DEVICE FOR THE AERATION AND EMULSIFYING OF PULP FOR FLOTATION. Charles Taylor, Nogales, Ariz.

1,299,151. COMBINED WINDMILL AND AIR-COMPRESSING MECHANISM. John D. Ebert, Kinsley, Kans.

1,299,211. GAS-COMPRESSOR. Charles R. Neeson, New Rochelle, N. Y.

1,299,268-70. LOCOMOTIVE-BRAKE EQUIPMENT. Walter V. Turner, Wilkinsburg, Pa.

1,299,290. AIR-BRUSH. Johannes Berg, Chicago, Ill.

Six Months' Advance Notice

An important announcement will appear in the July issue of Compressed Air Magazine regarding an increase in the subscription price of the magazine and an increase in advertising rates, both effective as of January 1, 1920.

The type dress of the magazine will be altered also on that date and its size will be increased to the standard 9x12 inches.

Subscribers and advertisers will please carefully note the July announcement.

Compressed Air Magazine Co.